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ABSTRACT

Teacher and student editions of this document are one in a series of competency-based instructional materials for diesel technology programs. The series aligns with the medium/heavy diesel duty truck task list used by the National Institute for Automotive Service Excellence in the certification of medium/heavy duty truck technicians. Introductory pages in the teacher edition are training and competency profile, instructional/task analysis, basic skills icons and classifications, and basic skills matrix. Teacher pages may include unit contents, suggested activities, answers to assignments, written test with answers, learning activities sheets, teacher supplements, and transparency masters. The three units are general safety, workplace safety, and first aid. The student edition contains some or all of these components for each unit: unit contents, objective sheet, information sheet, student supplements, assignment sheets, and job sheets. (YLB)

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Diesel Technology: Safety Skills. Second Edition. Teacher Edition [and] Student Edition.

Mary Kellum

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Diesel Technology

Safety Skills

Second Edition

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Diesel Technology: Safety Skills

Second Edition

Teacher Edition

Written by

Mary Kellum

Developed by

The Multistate Academic and Vocational Curriculum Consortium, Inc.

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Foreword

When MAVCC began the process for revising its diesel mechanics series, we wanted to develop a set of instructional materials that would provide students with the cognitive (knowing), psychomotor (doing), and affective (attitude) skills necessary to be successful in the diesel trade and that would address the emerging technology in the field. With the help of extremely qualified teachers, industry representatives, and writers, our new diesel technology series offers secondary and postsecondary students an excellent opportunity for learning required skills in the diesel industry.

The series aligns with the medium/heavy duty truck task list developed by the National Automotive Technicians Education Foundation (NATEF) and used by the National Institute for Automotive Service Excellence (ASE) in the certification of medium/heavy duty truck technicians. Our series addresses all but one of the ASE certification areas, gasoline engines, and includes the following publications: *Introduction*, *Safety Skills*, *Workplace Skills*, *Brakes*, *Steering and Suspension*, *Engines*, *Electrical and Electronic Systems*, *Air Conditioning*, *Drive Trains*, and *Hydraulics*. Each publication will include a matrix showing where the NATEF tasks are being taught.

The new publications will also reflect those tasks identified by MAVCC's technical committee which were not covered in the NATEF task list, especially those dealing with the maintenance and repair of diesel-powered heavy equipment and farm equipment.

The skills presented in this publication, *Diesel Technology: Safety Skills*, will be useful to any student pursuing a career in the diesel industry. Today, safety skills are mandatory to be successful in the workplace.

Mervin Birdwell, Chair
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Appreciation is extended to those individuals who contributed their time and talent to the development of *Diesel Technology: Safety Skills*.

The content of this publication was planned by the following members of the MAVCC diesel revision committee:

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Special appreciation is extended to the employees of the Graphics Division of the Oklahoma Department of Career and Technology Education for creating the original artwork and printing this text.

Use of This Publication

Diesel Technology: Safety Skills is available in both a teacher and student edition. The contents of these materials are tied to measurable and observable learning outcomes that were identified and validated by the diesel advisory committee, comprised of business/industry representatives and teachers. Competencies in the diesel technology series align with the medium/heavy duty truck task list developed by the National Automotive Technicians Education Foundation (NATEF) and used by the National Institute for Automotive Service Excellence (ASE) in the certification of medium/heavy duty truck technicians.

Teacher Edition

The complete teacher edition consists of introductory pages, teacher pages, and the student edition. The introductory pages and teacher pages are loose-leaf and three-hole punched, and the student edition is perfect bound and three-hole punched. The teacher edition is divided into units of instruction that may be broken into more than one lesson or class period. For added flexibility, each unit is individually numbered beginning with a T for teacher page, followed by the unit number and page number.

Example:

Page 17 of Unit 3 in the teacher pages are represented as T 3–17.

MAVCC—*Diesel Technology: Safety Skills* T 3–17

Page 1 of Unit 5 in the teacher pages are represented as T 5–1.

MAVCC—*Diesel Technology: Safety Skills* T 5–1

Pages in the student edition are numbered beginning with the unit number, followed by the page number.

Example:

Page 7 of Unit 5 in the student edition is represented as Page 5–7.

MAVCC—*Diesel Technology: Safety Skills* Page 5–7

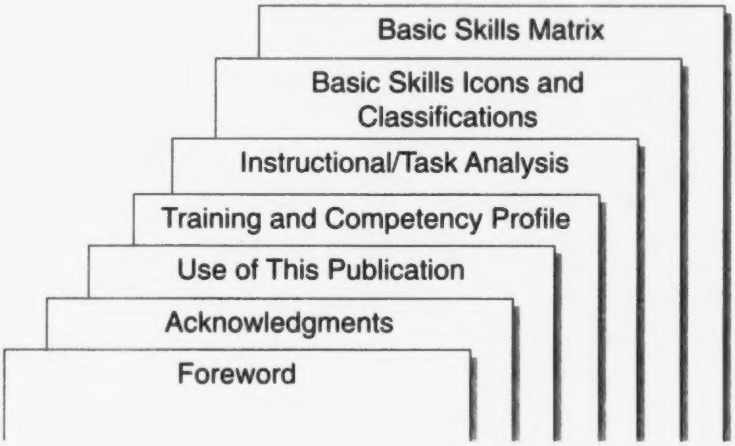
Use of This Publication

For group instruction, the teacher should determine the best way to teach each objective and allow for student participation. For self-paced or individualized instruction, students should be provided with opportunities to become involved in planning and being responsible for their own education. Careful study of each unit of instruction by the teacher will help to determine the following:

- amount of material that can be covered in each class period;
- supplies and materials required for assignment sheets and job sheets;
- resource people who must be contacted;
- supplementary materials to be ordered;
- skills that must be demonstrated and the amount of class time needed for demonstrations; and
- amount of class time needed for student practice and return demonstrations of mastered skills.

Teachers are encouraged to localize and personalize these materials to meet the needs of individual students, the community, and prospective employers.

Introductory Pages


Basic Skills Matrix
Basic Skills Icons and Classifications
Instructional/Task Analysis
Training and Competency Profile
Use of This Publication
Acknowledgments
Foreword

In addition to general information, such as the table of contents, acknowledgments, and the use of this publication, the following tools have been provided to assist administrators and teachers in planning for instruction.

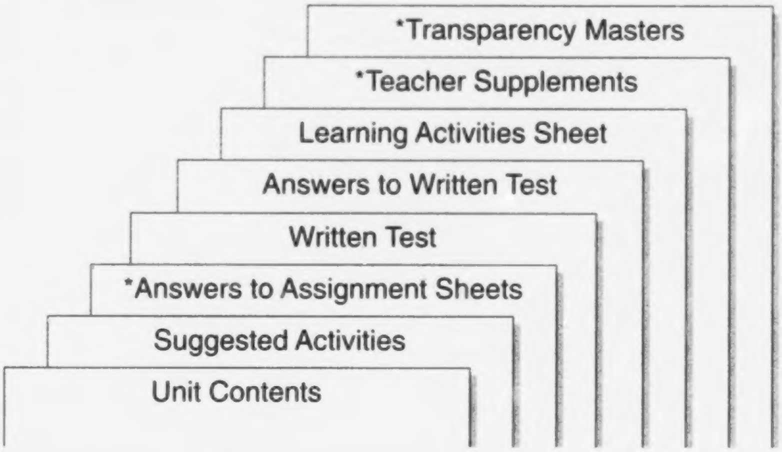
☐ **Training and Competency Profile.** This form may be copied and used to record information about each student, such as enrollment dates, class attendance, and work experience, and to document the student's mastery of specific job competencies. It can also be used to provide information about the student's qualifications to potential employers and/or for entry into advanced training programs.

- ☐ **Instructional/Task Analysis.** This document provides a quick review of the contents of this publication by identifying the cognitive skills (what the student should know) and psychomotor skills (what the student should be able to do) addressed in each unit of instruction.

- ☐ **Basic Skills Icons and Classifications.** This page provides a reference guide of the graphic symbols that are used to identify the basic academic and workplace skills included in each assignment sheet and job sheet.

- ☐ **Basic Skills Matrix.** This document graphically summarizes the academic and workplace skills training included in the instructional materials, unit by unit. It should be helpful to teachers in planning for instruction, and to administrators as documentation that basic skills are being taught as part of the vocational training.

Teacher Pages



*Designates components that may not appear in every unit of instruction

Teachers should study the teacher and student pages before introducing the unit, allowing enough time to obtain supplemental materials and to contact outside resource persons.

- ☐ **Suggested Activities.** This component assists teachers during the preparation stage of the teaching/learning process by providing an instructional plan, teaching suggestions, a list of references used in the development of each unit, and a list of suggested supplemental resources (books, posters, pamphlets, videotapes, computer software, and Internet sites) that may be used to enhance instruction.

  Instructions for evaluating student performance on the assignment sheets and job sheets are also included in the suggested activities section. Teachers should select and discuss with students the rating scale that will be used.

Use of This Publication

☐ **Answers to Assignment Sheets.** An answer key is provided, when applicable, to assist the teacher in evaluating student performance on a given assignment.

☐ **Written Test.** This component provides criterion-referenced evaluation of every cognitive objective listed in the unit of instruction, and serves as both a pretest and posttest to assist teachers in measuring each student's competency gains. (Assignment sheet and job sheet objectives are not evaluated on the written test.) If the teacher has added, deleted, or modified any objectives, appropriate changes should be made to both the test and answers to the written test.

Tests may be divided into shorter tests covering three or four objectives at a time and given soon after those objectives have been covered. A selection of test items from the units covered may be used for a final test at the end of each term if desired. The written test is included in the teacher edition only and should be duplicated for student use.

☐ **Answers to Written Test.** An answer key is provided to assist the teacher in evaluating student performance on the written test.

☐ **Learning Activities Sheet.** This component provides a model for teachers to use in implementing a self-paced or individualized program, and guides the student through the required components in the student edition (objective sheet, information sheet, student supplements, assignment sheets, and job sheets). The teacher should modify the learning steps as needed to incorporate resources available in the classroom (videotapes, computer software, magazines, etc.) and to address instructional strategies that may be needed to enhance learning for each student. Final copies should be distributed for student use.

The following icons will be used on the learning activities sheet to denote steps that require additional resources:

📖 Read a book, magazine, or journal article

💻 Use a CBT program or other software application

www Access a site on the World Wide Web

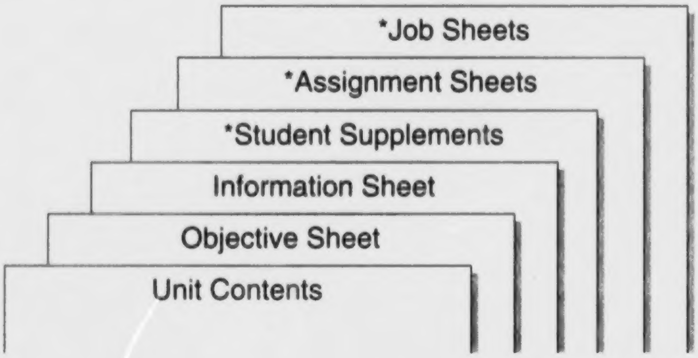
🖥 Look at PowerPoint® or other computer presentation

📼 Watch a videotape

☐ **Teacher Supplements.** These are optional materials for the teacher to use. They have three purposes: to provide the teacher with higher-level materials to stretch the advanced student; with remedial information or practice to assist the less-advanced student; and with state-of-the-art information in which the teacher may not have a background or with information that is not readily available in other books. Some teacher supplements may be duplicated for student use and are marked accordingly.

☐ **Transparency Masters.** These overheads are used to direct the students' attention to the topic of classroom discussion. Transparencies allow the student to see as well as hear the information being presented, thus reinforcing the learning process. They may provide illustrations, charts, schematics, or additional information needed to clarify and reinforce objectives included in the unit of instruction. Some of these items may also appear with the appropriate objectives in the information sheet in the student edition. The teacher may make acetate copies from the masters or, in most cases, complete transparency sets are available for purchase.

Student Edition



*Designates components that may not appear in every unit of instruction

For best results, students should be provided with a copy of the student edition and should be allowed to take notes in the margins as additional information is provided by the instructor or as the student acquires additional information through library or Internet research.

☐ **Objective Sheet.** This component summarizes each unit for the student and teacher. The objective sheet is based on established performance objectives that state the goals for successful completion of a unit of instruction. Objectives are stated in two forms: unit objectives that state the expected performance of each student after completion of the unit and specific (enabling) objectives that state what the student must be able to do to reach the unit objective.

The objectives should be stressed throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods.

Teachers should modify, delete, or add objectives in order to meet the needs of the students and community. When objectives are added, the teacher should remember to supply the needed information, assignment and/or job sheets, and criterion-referenced test items to cover the new objectives.

- ☐ **Information Sheet.** This component provides the student with the essential information for meeting the cognitive objectives in the unit. Teachers will find that the information sheet serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective. Students should read the information sheet before the information is discussed in class. Space is provided in the margins for students and teachers to add notes that clarify and/or expand upon the information presented.

- ☐ **Student Supplements.** This component is included in a unit of instruction when additional information is needed in order for students to complete one or more of the assignment and/or job sheets. Students are not directly tested over the information presented in a supplement; however, their ability to apply this information may be evaluated in the completion of assignment and/or job sheets.

- ☐ **Assignment Sheets.** The assignment sheets address the learning levels at or above the application level of Bloom's taxonomy. They provide students with an opportunity to use higher-order thinking skills, such as problem solving, synthesizing, analyzing, and evaluating. In addition, they may provide additional opportunities for students to develop their language skills.

  Assignment sheets can be paper-and-pencil activities, as well as those using computer software, videotapes, models, handouts, or other resources as appropriate. Criteria are provided to evaluate student performance objectively.

- ☐ **Job Sheets.** Job sheets are designed as skill tests and give the instructor direction as to the psychomotor skills to be taught, and provide the criteria to evaluate student performance objectively. They also help provide potential employers with a picture of the skills being taught during training and the performances that might be reasonably expected from an individual who has completed the training.

The teacher should provide students with a copy of each job sheet and/or the procedure's manual and/or job specifications when necessary. The teacher should also discuss the equipment and materials that will be needed for the job and the criteria that will be used to evaluate the student's performance, and demonstrate the procedure prior to having students practice the procedure. Safety should be stressed as part of each demonstration.

When a student is ready to be evaluated, the teacher should follow the instructions for evaluating student performance which may be found in the suggested activities component of the teacher unit.

As you use these instructional materials we hope that you will find that they contribute to the quality of your program. If any problems occur or if you have any suggestions for improvement of the materials, please write us at 1500 West Seventh Avenue, Stillwater, OK 74074-4364, or e-mail us at mavcc@mavcc.com.

Training and Competency Profile

Student Information

Program ____________________ Instructor ____________________

Name ____________________ Soc. Sec. No. ____________________

Address ____________________ Phone ____________________

Grade ____________________ School ____________________

Allergies/Disabilities that might require special accommodation for training (please specify)

____

In case of emergency, contact ____________________ Phone ____________________

Record of Enrollment

Date of Enrollment ____-____-____ Total Class Hours ________ Total Hours Absent ________

Date of Withdrawal ____-____-____ Total On-the-Job Training Hours ________ Total Hours Tardy ________

Date of Completion ____-____-____ Total Lab Hours ________

On-the-Job Training/Work Experience

Place of Employment ____________________ Address ____________________

Supervisor's Name ____________________ Phone ____________________

Duration of Employment ____________________ Job Title ____________________

Job Responsibilities ____________________

Place of Employment ____________________ Address ____________________

Supervisor's Name ____________________ Phone ____________________

Duration of Employment ____________________ Job Title ____________________

Job Responsibilities ____________________

Training and Competency Profile

Student Evaluation

Directions: Evaluate the student using the rating scale below. Write the appropriate number to indicate the degree of competency achieved. The descriptions associated with each of the numbers focuses on a level of student performance for each of the tasks listed. The written test scoreline is provided for optional teacher use. It may not be applicable in all cases.

Rating Scale: Option A

4	Skilled—Can perform job with no additional training
3	Moderately Skilled—Has performed job during training program; limited additional training may be required.
2	Limited Skill—Has performed job during training program; additional training is required to develop skill.
1	Unskilled—Is familiar with process, but is unable to perform job.
0	No Exposure—No information or practice provided during training program, complete training required.
NA	Non-applicable.

Rating Scale: Option B

Yes—Can perform with no additional training
No—Is unable to perform satisfactorily

Unit 1: General Safety

_______ 1. Subscribe to a safety pledge.
_______ 2. Apply general safety principles to the school and workplace.
_______ 3. Determine correct fire extinguishers to use for various situations.
_______ 4. Lift a heavy object properly.
_______ 5. Operate a fire extinguisher.
_______ 6. ______________________________
_______ Written Test Score

Unit 2: Workplace Safety

_______ 1. Interpret a material safety data sheet.
_______ 2. Compile a list of hazardous materials found in your shop and provide additional information on the most common materials.
_______ 3. Apply the safety color code to diesel technology shops.
_______ 4. Identify workplace safety violations.
_______ 5. Complete an individual student shop safety inspection.
_______ 6. ______________________________
_______ Written Test Score

Unit 3: First Aid

_______ 1. Determine basic first aid measures for given emergency situations.
_______ 2. ______________________________
_______ Written Test Score

Diesel Technology: Safety Skills

Instructional/Task Analysis

Related Information: What the Student Should Know

Application: What the Student Should Be Able to Do

Unit 1: General Safety

Related Information: What the Student Should Know

1. Terms and definitions
2. Ways of developing a good safety attitude
3. Expectations for a safe environment at school or work
4. Basic types of emergencies
5. Severe weather guidelines
6. Steps to follow in case of a bomb threat
7. How to conduct a fire evacuation
8. Personal protective equipment
9. Personal safety guidelines
10. Guidelines for maintaining a safe work area
11. Causes of back injuries
12. Lifting and moving items safely
13. Components of a fire
14. Classifications of fires and their fuel sources
15. Types of fire extinguishers
16. Fire extinguisher symbols
17. Steps in using a fire extinguisher
18. Ways to prevent fires

Application: What the Student Should Be Able to Do

19. Subscribe to a safety pledge
20. Apply general safety principles to the school and workplace
21. Determine correct fire extinguishers to use for various situations
22. Lift a heavy object properly
23. Operate a fire extinguisher

Unit 2: Workplace Safety

1. Terms and definitions
2. Federal agencies that regulate hazardous materials and hazardous waste
3. OSHA's role in workplace health and safety
4. Hazard communication
5. Information on a chemical label
6. Purposes of a material safety data sheet
7. Characteristics of a hazardous material

Instructional/Task Analysis

Related Information: What the Student Should Know

Application: What the Student Should Be Able to Do

Unit 2: Workplace Safety (continued)

8. Ways hazardous materials can enter the body
9. Short-term and long-term health effects from exposure to hazardous materials
10. Hazardous material diamond classification system
11. Hazardous materials that may be found in the diesel technology shop
12. Hazardous waste products associated with the diesel technology shop
13. Guidelines for storing and disposing of hazardous materials
14. Guidelines for using flammable materials and toxic substances
15. Equipment and tool safety guidelines
16. Electrical safety guidelines
17. Colors of the federal safety color code and their uses
18. Safety tags and their color codings
19. General safety guidelines for working on vehicles
20. Overview of asbestos and guidelines for reducing asbestos exposure
21. Interpret a material safety data sheet
22. Compile a list of hazardous materials found in your shop and provide additional information on the most common materials
23. Apply the safety color codes to diesel technology shops
24. Identify workplace safety violations
25. Complete an individual student shop safety inspection

Unit 3: First Aid

1. Terms and definitions
2. Major causes of accidents
3. Injuries that may occur in the diesel shop
4. Basic types of accident injuries
5. Steps for giving first aid
6. Times to call for emergency medical service
7. Information to give during an emergency phone call

Related Information: What the Student Should Know

Application: What the Student Should Be Able to Do

Unit 3: First Aid (continued)

Related Information: What the Student Should Know

8. Legal aspects of first aid
9. Contents of a first aid box
10. Bloodborne pathogens and special first aid precautions
11. Basic first aid procedures for various emergencies
12. Steps on how to treat choking
13. Guidelines for giving mouth-to-mouth breathing
14. Basic steps for performing cardiopulmonary resuscitation

Application: What the Student Should Be Able to Do

15. Determine basic first aid measures for given emergency situations

Basic Skills Icons and Classifications

To assist teachers and students in identifying and documenting where academic and workplace skills are being taught, MAVCC has adopted a system that uses icons and a list of specific tasks to identify the skill or skills that are used in each assignment sheet and job sheet.

A matrix for each of the ten broad skill areas has been included in this edition and reflects key elements from *What Work Requires of Schools: A SCANS Report for America 2000,* a 1991 study by the U.S. Department of Labor; *Workplace Basics: The Skills Employers Want,* a three-year study conducted jointly by the American Society for Training and Development (ASTD) and the United States Department of Labor (DOL); and other national and state sources.

Each of the ten broad skill areas—reading, writing, mathematics, science, oral communication, interpersonal or relating, critical thinking, employability, social studies, and technology—is represented by the icon presented below.

Reading Skills

- Reading Comprehension
- Research/Reference
- Functional Reading

Writing Skills

- Language
- Composition
- Research
- Functional Writing

Math Skills

- Operation and Calculation
- Math Application
- Data Analysis and Display
- Functional Math

Basic Skills Icons and Classifications

Science Skills

- General Science
- Life Science
- Physical Science
- Earth Science

Oral Communication Skills

- Oral Presentation
- Listening
- Interactive Communication

Interpersonal or Relating Skills

- General Relating
- Teamwork/Cooperation
- Leadership/Influence

Critical Thinking Skills

- Cognitive Activities

Employability Skills

- Job Search/Selections
- Job Acquisition/Development
- Resource Management
- Job Safety

Social Studies Skills

- Information Analysis
- Social Studies Application
- Functional Social Studies

Technology Skills

- Selection
- Application
- Maintenance/Troubleshooting

Unit 1: General Safety

Academic and Workplace Skills					
Obj. #	**Objective**	**Icon**	**Skill**	**Sub Skill**	**Description**
19	Subscribe to a safety pledge. (A.S. 1)		Reading	Reading comprehension	Comprehend written information for main ideas
			Employability	Job acquisition/ development	Follow established rules, regulations, and policies
20	Apply general safety principles to the school and workplace. (A.S. 2)		Reading	Reading comprehension	Analyze and apply what has been read to specific task; comprehend written information for main ideas
			Writing	Language	State ideas clearly
			Critical Thinking	Cognitive activities	Define a problem; devise a solution
			Employability	Job safety	Identify safety procedures required in the workplace; understand importance of safety to the organization
21	Determine correct fire extinguishers to use for various situations. (A.S. 3)		Reading	Reading comprehension	Analyze and apply what has been read to specific task; comprehend written information for main ideas
			Critical Thinking	Cognitive activities	Define a problem; devise a solution
			Employability	Job safety	Identify safety procedures required in the workplace; understand importance of safety to the organization
22	Lift a heavy object properly. (J.S. 1)		Reading	Reading comprehension	Analyze and apply what has been read to specific task
				Functional reading	Follow written instructions
			Employability	Job safety	Identify safety procedures required in the workplace; understand importance of safety to the organization
23	Operate a fire extinguisher. (J.S. 2)		Reading	Reading comprehension	Analyze and apply what has been read to specific task
				Functional reading	Follow written instructions
			Employability	Job safety	Demonstrate proper use of safety device

Basic Skills Matrix

Unit 2: Workplace Safety

Academic and Workplace Skills					
Obj. #	**Objective**	**Icon**	**Skill**	**Sub Skill**	**Description**
21	Interpret a material safety data sheet. (A.S. 1)	📖	Reading	Reading comprehension	Comprehend written information for main ideas; analyze and apply what has been read to specific task
				Functional reading	Interpret forms
		✎	Writing	Language	State ideas clearly
		💡	Critical Thinking	Cognitive activities	Collect/record information; transfer knowledge/training to new situations
		⛑	Employability	Job safety	Identify safety procedures required in the workplace; understand importance of safety to the organization
22	Compile a list of hazardous materials found in your shop and provide additional information on the most common materials. (A.S. 2)	📖	Reading	Reading comprehension	Gain factual information
				Functional reading	Follow written instructions
		✎	Writing	Functional writing	Use content area vocabulary; organizes information into an appropriate format
		💡	Critical Thinking	Cognitive activities	Collect/record information; draw conclusions
		⛑	Employability	Job safety	Identify safety procedures required in the workplace; understand importance of safety to the organization
23	Apply the safety color codes to diesel technology shops (A.S. 3)	📖	Reading	Functional reading	Follow written instructions
		💡	Critical Thinking	Cognitive activities	Identify critical elements
		⛑	Employability	Job safety	Understand importance of safety to the organization
24	Identify workplace safety violations. (A.S. 4)	📖	Reading	Reading comprehension	Determine what information is needed
				Functional reading	Follow written instructions

Unit 2: Workplace Safety (Continued)

Academic and Workplace Skills					
Obj. #	**Objective**	**Icon**	**Skill**	**Sub Skill**	**Description**
		💡	Critical Thinking	Cognitive activities	Identify critical elements; define a problem
		💼	Employability	Job safety	Identify safety procedures required in the workplace
25	Complete an individual student shop safety inspection. (A.S. 5)	📚	Reading	Reading comprehension	Analyze and apply what has been read to specific task
				Functional reading	Follow written instructions
		💡	Critical Thinking	Cognitive activities	Analyze information; draw conclusions
		💼	Employability	Job acquisition/ development	Follow established rules, regulations, and policies; promote the goals and values of the organization; set high standards for self in completion of a task
				Job safety	Understand importance of safety to the organization

Basic Skills Matrix

Unit 3: First Aid

Academic and Workplace Skills					
Obj. #	**Objective**	**Icon**	**Skill**	**Sub Skill**	**Description**
15	Determine basic first aid measures for given emergency situations. (A.S. 1)		Reading	Reading comprehension	React to written material; analyze and apply what has been read to specific task; comprehend written information for main ideas
				Functional reading	Follow written instructions
			Writing	Language	Use standard grammar, spelling, and capitalization; state ideas clearly
			Critical Thinking	Cognitive activities	Analyze information; define a problem; draw conclusions; devise a solution; transfer knowledge/training to new situations
			Employability	Job acquisition/ development	Follow established rules, regulations, and policies
				Job safety	Understand importance of safety to the organization

Unit 1 General Safety

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1—Lift a Heavy Object Properly 1–29
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Suggested Activities

Instructional Plan

Preparation

- Read the unit carefully and plan for instruction.
- Review "Teaching Suggestions." Plan for classroom activities.
- Plan your presentation to take advantage of student learning styles and to accommodate special-needs students.
- Prepare classroom. Put up posters and charts and display articles and other references related to this unit.
- Obtain films, videotapes, and other resources to supplement instruction of this unit. See "Resources Used in Developing This Unit" and "Suggested Supplemental Resources" for more information.
- For self-paced instruction, review Learning Activities Sheet. Modify as appropriate to include additional activities and/or resources available in your classroom. Make one copy for each student.
- Make transparencies from the transparency masters included in this unit. These appear in the teacher edition only.

Delivery and Application

Unit Introduction (self-paced instruction)

- Provide student with Learning Activities Sheet and unit of instruction.
- Review unit contents with student.
- Have the student complete the steps in the learning activities sheet.

Unit Introduction (group instruction)

- Provide students with unit of instruction.
- Discuss unit and specific objectives.
- Discuss the information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.
- Discuss the assignment sheets. Review with students the criteria for evaluation of these activities.
- Discuss and demonstrate the job sheets. Make sure all required tools, equipment, and materials are available. Review with students the criteria for evaluation of these activities and the rating scale that will be used to indicate job performance.

Suggested Activities

Teaching Suggestions

- Discuss what it means to be a "safe" person.
- Lead students on a tour of the shop and point out mechanical, fire, chemical, light, and noise hazards.
- Have students make shop safety posters related to general safety or fire safety.
- Discuss severe weather procedures to follow when at school and/or at the workplace site. Relate situations that may be appropriate to your area concerning weather or natural disasters.
- Role play a "bomb threat" situation. How much information can be obtained to report to the authorities?
- Display the various types of personal protective equipment that students should wear in the diesel shop.
- Explain classroom fire drill procedures, including the evacuation routes and fire exits. Also discuss where to meet outside, how everyone will be accounted for, and what the "all-clear" signal will be. Then have students participate in a fire drill.
- Arrange for the local fire department to demonstrate the use of fire extinguishers. Have them show several types if possible, and then show the type available in your classroom or shop. Have the department help establish a safe area where the students can learn to put out fires for Job Sheet 2 in this unit.
- Discuss fire hazards in the diesel shop. Relate to the class actual fires you have seen or been involved in. Discuss the after effects of the fire (legal, financial, and emotional).
- Post emergency telephone numbers for your area next to the classroom and/or shop telephone.
- Obtain and show safety videotapes. See "Suggested Supplemental Resources" for ordering information.
- Demonstrate proper lifting techniques, following the steps listed in the information sheet.

Evaluation

- Make copies of the written test. Add or modify test items as needed. The written test serves as both a pretest and posttest to assist in measuring each student's competency gains.
- Give and evaluate pretest. Modify lesson plan to include additional instruction for those areas where students were deficient.

Suggested Activities

- Evaluate the assignment sheets. Rate the student using the criteria listed on each assignment sheet. See Answers to Assignment Sheets for correct answers where applicable. If the student's performance is unacceptable, have the student review the appropriate materials and complete the assignment again.
- Evaluate the job sheets. When the student is ready to perform a specific task, obtain a copy of the job sheet which may be found in the student edition. Then observe the student performing the procedure.

  Process evaluation—Place a mark in the box to the left of each designated checkpoint if the student has satisfactorily completed the process step(s) for each checkpoint area. If the student is unable to complete the procedure correctly, have the student review the materials and try again.

  Product evaluation—Once the student has satisfactorily completed the procedure, rate the student product (outcome) using the criteria that are provided as part of the job sheet. If the student's product is unacceptable, have the student review the materials and submit another product for evaluation.

  Two sample performance evaluation keys have been provided below. Many other keys are available. Select one rating (grading scale) that best fits your program needs.

  Sample A

  4—**Skilled**—Can perform job with no additional training.
  3—**Moderately skilled**—Has performed job during training program; limited additional training may be required.
  2—**Limited skill**—Has performed job during training program; additional training is required to develop skill.
  1—**Unskilled**—Is familiar with process, but is unable to perform job.
  0—**No exposure**—No information or practice provided during training program.

  Sample B

  Yes—Can perform job with no additional training.
  No—Is unable to perform job satisfactorily.

- Give and evaluate the posttest.
- Meet individually with students to evaluate their progress through this unit of instruction and indicate to them possible areas of improvement.
- Reteach and retest as required.

Resources Used in Developing This Unit

Print Media

- *An Accident Prevention Program for School Shops and Laboratories.* Office of Education/U.S. Department of Health, Education, and Welfare.
- *The ABC's of Fire Protection.* Belleville, NJ: Walter Kidde and Company.
- *Making Safety Work.* Chicago, IL: National Safety Council.

- *Safety and Health.* San Francisco: Parlay International.
- *Safety on the Job: Some Guidelines for Working Safely.* Stillwater, OK: CIMC/Oklahoma Department of Career and Technology Education, 1989.

Suggested Supplemental Resources

Print Media

- OSHA Fact Sheets
  - *Job Safety and Health*, 93-01
  - *Eye Protection in the Workplace*, 93-03
  - *Protect Yourself with Personal Protective Equipment*, 92-08
  - *Back Injuries–Nation's Number One Workplace Safety Problem*, 93-09
  - *Responding to Workplace Emergencies*, 92-19
  - *Workplace Fire Safety*, 93-41

  The fact sheets listed above are available from regional OSHA offices, the OSHA Web site, or from:

  U.S. Department of Labor
  Occupational Safety and Health Administration (OSHA)
  200 Constitution Avenue, N.W.
  Washington, D.C. 20210
  http://www.osha-slc.gov/OshDoc/Fact_toc/Fact_toc_by_num.html

- Safety signs and posters

  Available from:

  National Safety Council
  1121 Spring Lake Drive
  Itasca, IL 60143
  Toll-free: 800-621-7619
  http://www.nsc.org

Electronic Media

- Videos

  The following videos are also available as CD-ROMs. The CDs allow students to take a test with full tracking of how many questions were answered correctly or incorrectly.

  - *Employee Safety Orientation for Automotive Personnel* (14 minutes)—This video instructs new and experienced personnel in general hazards exposure in an automotive shop, such as tool safety, maintenance, eye protection, electricity, etc. Meets OSHA training requirements. (D43007)

- *Eye Protection–A New Approach* (Humorous, 16 minutes)—This video approaches the problem of employees not wanting to wear safety glasses. Produced with some humor, but stresses the need for proper eye protection. (D40007)

- *Personal Protective Equipment* (10 minutes)—Emphasizes the importance of using personal protection when required. Addresses hard hats, gloves, eye protection, hearing protection, and other aspects of protective equipment. (D21007)

- *Hearing Conservation* (11 minutes)—This video heightens awareness of hearing conservation in the workplace. It explains the anatomy of the ear, how noise can cause hearing loss, and how to prevent hearing loss. (D55007)

- *Respirators and How to Use Them* (10 minutes)—Program explains the different types of respirators, how they are used, some of their capabilities and limitations. (D51007)

- *Fit Testing Respirators* (10 minutes)—This program covers the requirements under NIOSH Standards for quantitative and qualitative fit testing procedures. (D52007)

- *Fire Extinguisher Training and Use 2000*—This program explains the various classes of fires, different types of fire extinguishers, the key word PASS, and other tips for emergency use of fire extinguishers. (D25007)

- *Fire Protection/Electrical Safety* (9 minutes)—This program covers extinguishers, sprinklers, chemicals, codes, receptacles, and electrical safety. (D47007)

- *Back Injury Prevention*—The variety of lifting tasks in the manufacturing industry require specific techniques under difficult conditions and hazards resulting from incorrect methods. (D10007)

To order these videos or CD-ROMs, contact:

MAVCC
1500 West Seventh Avenue
Stillwater, OK 74074
Sales: 1-800-654-3988
www.mavcc.org
E-mail: mavcc@mavcc.com

Answers to Assignment Sheets

Assignment Sheet 1

Subscribe to a Safety Pledge

Evaluate according to the criteria stated on the assignment sheet.

Assignment Sheet 2

Apply General Safety Principles to the School and Workplace

Evaluate according to the criteria stated on the assignment sheet.

Assignment Sheet 3

Determine Correct Fire Extinguishers to Use for Various Situations

a. 1, 2
b. 2, 3
c. 2, 3
d. 2, 3
e. 2
f. 2, 3
g. 1, 2
h. 2, 3
i. 2, 3
j. 2

Written Test

Name ____

Date ______________________________ Score __________

Objective 1

Match the terms with their definitions.

1. Accident
2. Carelessness
3. Drill
4. Emergency
5. Evacuation
6. Extinguish
7. Hazard
8. Personal protective equipment
9. Safety

_____ a. Source of danger

_____ b. To put out a fire; to cause to cease burning

_____ c. Exercise practiced so that all members can demonstrate what to do in case of an emergency

_____ d. Freedom from danger, risk, or injury

_____ e. Moving people out of a disaster or dangerous area into a safe place

_____ f. Any suddenly occurring, unintentional event that causes injury or property damage

_____ g. Devices used or worn to protect the physical health of an equipment operator or tool user

_____ h. Any accident or sudden illness that requires immediate intervention to prevent severe damage or death

_____ i. Failure to think before one acts; failure to pay attention

Objective 2

Discuss at least three ways of developing a good safety attitude.

a. ____

____

b. ____

____

c. ____

____

Written Test

Objective 3

List six expectations for a safe environment at school or work.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

e. ____________________

f. ____________________

Objective 4

List four basic types of emergencies.

a. ____________________

b. ____________________

c. ____________________

d. ____________________

Objective 5

Discuss at least three severe weather guidelines.

a. ____________________
____

b. ____________________
____

c. ____________________
____

Objective 6

Arrange in order the following steps to follow in case of a bomb threat by placing the correct sequence numbers (1–5) in the appropriate blanks.

_____ a. When you answer the call, obtain as much information as possible from and about the caller. Record the call if possible.

_____ b. Alert your instructor, supervisor, or building administrator immediately.

_____ c. A building search will be conducted by police/bomb squad.

_____ d. An "All Clear" signal will be given when it is safe to return to the building.

_____ e. Begin building evacuation immediately.

Objective 7

Describe how to conduct a fire evacuation.

a. Upon discovery of a large fire or smoke or activation of a smoke detector, you should:

____

____

____

b. Evacuate building as soon as alarm sounds in the following manner:

____

____

____

Objective 8

List the following types of personal protective equipment.

a. Eye protection

- ______________________________
- ______________________________

b. Hearing protection

- ______________________________

c. Head protection

- ______________________________
- ______________________________

d. Foot protection

- ______________________________

e. Hand protection

- ______________________________
- ______________________________

f. Respiratory protection

- ______________________________
- ______________________________

Written Test

Objective 9

Distinguish between correct and incorrect personal safety guidelines by circling "Do" or "Don't" as appropriate.

a. **(Do, Don't)** wear personal protective equipment as required.

b. **(Do, Don't)** ignore safety rules and posted signs.

c. **(Do, Don't)** follow instructions when performing a task.

d. **(Do, Don't)** operate, adjust, or repair equipment without permission and proper training.

e. **(Do, Don't)** report defective tools and equipment immediately.

f. **(Do, Don't)** report all accidents and get first aid immediately.

g. **(Do, Don't)** correct or report all unsafe conditions immediately.

h. **(Do, Don't)** keep mentally alert to shop hazards.

i. **(Do, Don't)** conduct yourself in a manner conducive to safe shop practices.

j. **(Do, Don't)** "horse around" on the job.

Objective 10

Complete the following guidelines for maintaining a safe work area by filling in the blanks with one of the following words:

approved metal containers
clean
ease of cleaning
immediately available
materials and supplies
obstacles and slippery substances
organized
traffic areas

a. Arrange equipment and vehicles to allow safe working practices and ______

____

b. Store ______________________________ safely in their proper places.

c. Keep work area ______________ and clear of debris and other hazards.

d. Keep floors clear of ______________________________________.

e. ______________________________________ up spills immediately.

f. Keep electrical cords and extension cords out of ____________________.

g. Store oily, greasy, and paint-soaked rags in ________________________.

h. Know where first aid and fire fighting equipment are kept so they are

______________________________________ in case of an emergency.

Objective 11

Match causes of back injuries with their contributing factors.

1. Improper position
2. Improper reaching
3. Improper storage
4. Obstructions
5. Shape
6. Size
7. Weight

_____ a. Injury usually results from overestimating your physical abilities and trying to lift more weight than you can handle.

_____ b. Injury usually results from moving an object that may be within your weight capacity, but is too long, high, or wide to lift safely.

_____ c. Injury usually results from moving an object that may be within your weight capacity, but has a cylindrical or other odd shape that makes lifting difficult.

_____ d. Injury usually results from stacking materials so high that vision is limited and obstructions in the pathway cannot be seen.

_____ e. Injury usually results from twisting or turning to an awkward position when lifting.

_____ f. Injury usually results from using chairs or boxes to stand on instead of safely using a ladder, or by positioning object too far from work.

_____ g. Injury usually results in strain caused by not storing heavy objects at least 12 inches off the floor.

Objective 12

Complete the following guidelines for lifting and moving items safely by selecting the correct answers. Write the correct numbers in the blanks.

Before lifting

_____ a. Inspect the item to be lifted for ______, and grease or other slippery surfaces.

1. wrapping, handholds
2. jagged edges, splinters
3. size, weight
4. obstacles, wrapping

_____ b. Wear ________________ for protection, and make sure that they fit correctly.

1. steel-toed shoes
2. safety goggles
3. ankle supports
4. gloves

_____ c. Clear any ____________ from your path.

1. obstacles
2. customers
3. employees
4. floor coverings

_____ d. Assess the ____________ of the load.

1. area
2. circumference
3. square footage
4. weight

_____ e. ______________ to lift heavy loads.

1. Use your back
2. Get help
3. Call a professional
4. Use a pry bar

Lifting

_____ f. Place your ____________ as close to the load as possible.

1. head
2. shoulders
3. hip
4. feet

_____ g. Bend your knees, keeping your ________________ straight and your chin tucked in.

1. leg muscles
2. arms and shoulders
3. back and neck
4. feet

_____ h. Draw your ______________ in close to your body.

1. arms
2. knees
3. feet
4. buttocks

_____ i. Stand slowly and lift smoothly, using your ________ .

1. legs
2. shoulders
3. back
4. knees

Carrying

_____ j. Hold the item ____________ .

1. at least 1 foot from waist
2. at knee level
3. at shoulder level
4. close to your body

_____ k. Do not allow the load to __________.

1. touch your chest
2. rest on your shoulder
3. block your vision
4. shift toward your body

Setting the load down

_____ l. Bend your ____________ .

1. arms
2. knees
3. back
4. head

Objective 13

List three components of a fire.

a. ________________________________

b. ________________________________

c. ________________________________

Written Test

Objective 14

Match the classifications of fires with their fuel sources.

1. Class A
2. Class B
3. Class C
4. Class D

_____ a. Fires that occur in or near electrical equipment (wiring, appliances)

_____ b. Fires that occur with ordinary combustible materials (wood, paper, trash)

_____ c. Fires that occur with flammable liquids (gas, oil, paints)

_____ d. Fires from combustible metals (magnesium)

Objective 15

Match the types of fire extinguishers with the classes of fires they are designed to extinguish.

1. Carbon dioxide
2. Dry chemical
3. Foam
4. Halon
5. Pressurized water

_____ a. Direct stream at base of fire; use for class A fires only.

_____ b. Stand back several feet, hold container upright and direct at the base of fire, sweeping from side to side; use for class B or class C fires.

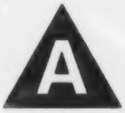
_____ c. Direct discharge as close to fire as possible, first at the edge of flames, then gradually forward and upward; use for class B or class C fires.

_____ d. Spray above fire, allowing to fall lightly on the fire; use for class A or class B fires.

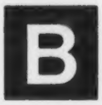
_____ e. Direct at the base of the flames, then follow up by directing at remaining materials that are burning; use for all classes of fires.

Objective 16

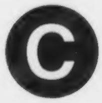
Match fire extinguisher symbols with their meanings. Answers may be used more than once.



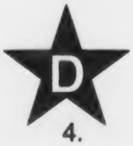
1.



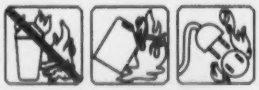
2.



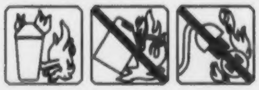
3.



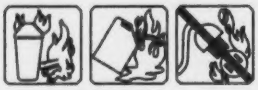
4.



5.



6.



7.

_____ a. Class A and B fires but not Class C fires

_____ b. Flammable liquids

_____ c. Class B and Class C fires but not Class A fires

_____ d. Ordinary combustibles

_____ e. Class A fires but not Class B and C fires

_____ f. Electrical equipment

_____ g. Combustible metals

_____ h. Yellow

_____ i. Blue

_____ j. Red

_____ k. Green

Objective 17

Arrange in order the steps in using a fire extinguisher by placing the correct sequence numbers (1–5) in the appropriate blanks.

_____ a. Aim the extinguisher nozzle at the base of the fire.

_____ b. Sweep from side to side until the fire appears to be out. Watch the fire area.

_____ c. Pull the pin. Some extinguishers require releasing a lock latch, pressing a puncture lever, or other step.

_____ d. Identify the class of fire (A–D) and then make sure your fire extinguisher is coded to put out that type of fire. Check the label on the fire extinguisher.

_____ e. Squeeze the handle. This releases the extinguishing agent.

Objective 18

Discuss at least seven ways to prevent fires.

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

***Permission to duplicate this test is granted.**

Answers to Written Test

Objective 1

a. 7
b. 6
c. 3
d. 9
e. 5
f. 1
g. 8
h. 4
i. 2

Objective 2

Discussion should include at least three of the following points (in the student's own words):

a. Focus on the present task. Stay alert. If you're tired or bored, accidents can happen.
b. Take time to do the job right. Staying safe may take a little extra time, but it will result in fewer mistakes. Determine what needs to be done first so you won't run out of time on high priority tasks.
c. Use your head. Do what you know is right. Don't take shortcuts or fool around. Also don't let emotions like anger or frustration get in the way of doing a good job.
d. Take responsibility for your actions. Others trust and depend on you to do your job correctly. If you do not act responsibly, others may suffer. Understand that safety is everyone's responsibility.
e. Avoid unnecessary risks. Think of what could happen if you take a chance on an unsafe task. Many risks are dangerous and are not worth it.

Objective 3

Any six of the following:

a. Lighting is adequate to perform required duties and to prevent eyestrain.
b. Air is clean, without harmful fumes.
c. Alarms are located to notify everyone in case of emergencies.
d. Emergency exits are clearly marked, unlocked, and accessible.
e. Emergency telephone numbers are posted.
f. Fire extinguishers are readily available.
g. First aid supplies are available.
h. Walkways are clear, barrier-free, and accessible to all.
i. Safety rules are posted.
j. Evacuation routes are posted.
k. All students/employees receive safety training.
l. Personal protective equipment is available for all.
m. No smoking/smoking areas are designated.
n. Adequate storage areas are provided for hazardous materials.
o. Hazardous materials are clearly identified.

Answers to Written Test

Objective 4

Any four of the following:

a. Fires
b. Bombs and bomb threats
c. Severe weather and natural disasters—Tornados, hurricanes, earthquakes, floods, etc.
d. Accidents—Falls, cuts, burns, electrical shocks, poisonings, etc.
e. Health problems—Heart attacks, strokes, seizures, heat exhaustion, etc.

Objective 5

Discussions should include at least three of the following guidelines (in student's own words):

a. When alarms (sirens) or warnings are issued by the local civil defense or national weather center, begin procedure to take cover.
b. Move quickly and quietly to shelter area on the lowest level and in the interior of the building away from glass and outside openings.
c. Sit down and protect yourself by putting your head as close to your lap as possible, or kneel down and cover your face and head with your arms.
d. Answer to roll call if at school.
e. Remain in designated area until the signal is given to return.

Objective 6

a. 1
b. 2
c. 4
d. 5
e. 3

Objective 7

a.
  - Pull the nearest fire alarm.
  - Close the doors around the fire to contain it.
  - Notify the building administrator or telephone operator (0 or 911) of the fire and its exact location.

b. Any three of the following:
  - Remain calm and move quickly to exits. Do not use the elevators.
  - Close windows and doors as you leave your area. This limits the amount of oxygen the fire receives and prevents the spread of smoke.
  - Feel closed doors before opening them. Doors that are hot indicate a fire on the other side.
  - If you are unable to exit through the door and you must wait for rescue through windows, place wet cloths on the floor next to the door to prevent the spread of smoke into the room. A wet towel over the head will help if you must walk through smoke to an exit. DO NOT ENTER THICK SMOKE.
  - Once at the designated area, remain calm and stay with your group. All persons must be accounted for.

Answers to Written Test

Objective 8

a. Any two of the following:
  - Goggles
  - Safety glasses with side panels
  - Face shield
  - Welding helmet with filter lenses

b. Any of the following:
  - Ear plugs
  - Ear muffs

c. Any two of the following:
  - Full-brimmed hard hat
  - Visored hard hat
  - Bump caps
  - Hair covers

d. Any of the following:
  - Safety shoes, steel reinforced toe box and insole
  - Safety boots

e. Any two of the following:
  - Disposable gloves
  - Fabric gloves
  - Rubber gloves
  - Leather gloves

f. Any two of the following:
  - Filtration respirators
  - Purifying respirators
  - Air-supplying respirators

Objective 9

a. Do
b. Don't
c. Do
d. Don't
e. Do
f. Do
g. Do
h. Do
i. Do
j. Don't

Objective 10

a. Ease of cleaning
b. Materials and supplies
c. Organized
d. Obstacles and slippery substances
e. Clean
f. Traffic areas
g. Approved metal containers
h. Immediately available

Objective 11

a. 7
b. 6
c. 5
d. 4
e. 1
f. 2
g. 3

Objective 12

a. 2
b. 4
c. 1
d. 4
e. 2
f. 4
g. 3
h. 1
i. 1
j. 4
k. 3
l. 2

Answers to Written Test

Objective 13

(Any order)

a. Fuel
b. Heat
c. Oxygen

Objective 14

a. 3
b. 1
c. 2
d. 4

Objective 15

a. 5
b. 4
c. 1
d. 3
e. 2

Objective 16

a. 7
b. 2
c. 5
d. 1
e. 6
f. 3
g. 4
h. 4
i. 3
j. 2
k. 1

Objective 17

a. 3
b. 5
c. 2
d. 1
e. 4

Objective 18

Discussion should include at least seven of the following guidelines (in student's own words):

a. Keep equipment clean and in good operating condition.
b. Never overload electrical circuits.
c. Store flammable/combustible materials in appropriate containers away from heat sources.
d. Keep work and trash areas clean and free of debris.
e. Dispose of flammables according to established safety guidelines.
f. Never leave open flames unattended.
g. Use caution when operating spark-producing equipment.
h. Clean up spills (if appropriate) or report.
i. Report suspicious persons (possible arsonists) to security or supervisory personnel.
j. Keep fire exits/escape routes clear and well-marked.
k. Know where fire alarm boxes are located.
l. Know where fire extinguishers are located.
m. Always be on the lookout for fires or conditions that could cause a fire and report them immediately.
n. Properly dispose of cigarettes and matches.
o. Always obey "no smoking" signs and areas.

Prerequisites:
None

Learning Activities Sheet

Student Name ____

Place a checkmark in the appropriate box as you complete each of the steps below.

☐ 1. **Take** Pretest provided by instructor. After test has been evaluated, follow instructor's recommendations.

☐ 2. **Read** Objective Sheet.

Optional 📼 ☐ 3. **View** Videotape entitled *Employee Safety Orientation for Automotive Personnel.*

☐ 4. **Study** Information Sheet, Objectives 1 through 3.

☐ 5. **Do** Assignment Sheet 1, "Subscribe to a Safety Pledge."

☐ 6. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 7. If the evaluation is not satisfactory, repeat step 5.

☐ 7. **Study** Information Sheet, Objectives 4 through 7.

☐ 8. **Do** Assignment Sheet 2, "Apply General Safety Principles to the School and Workplace."

☐ 9. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat steps 7 through 9.

☐ 10. **Study** Information Sheet, Objective 8.

Optional 📼 ☐ 11. **View** Videotape entitled *Personal Protective Equipment.*

☐ 12. **Study** Information Sheet, Objective 9.

Optional 📼 ☐ 13. **View** Videotape entitled *Eye Protection—A New Approach.*

Learning Activities Sheet

	☐	14.	**Study**	Information Sheet, Objective 10.
Optional 📼	☐	15.	**View**	Videotapes entitled *Hearing Conservation, Respirators and How to Use Them,* and *Fit Testing Respirators.*
	☐	16.	**Study**	Information Sheet, Objectives 11 and 12.
Optional 📼	☐	17.	**View**	Videotape entitled *Back Injury Prevention.*
	☐	18.	**Observe**	Demonstration of procedures to be used in completing Job Sheet 1.
	☐	19.	**Do**	Job Sheet 1, "Lift a Heavy Object Properly."
	☐	20.	**Stop**	Have instructor evaluate your performance and if the evaluation is satisfactory, continue to step 21. If the evaluation is not satisfactory, study the procedure outlined in Job Sheet 1 and repeat steps 18 through 20.
	☐	21.	**Study**	Information Sheet, Objectives 13 through 18.
	☐	22.	**Do**	Assignment Sheet 3, "Determine Correct Fire Extinguishers to Use for Various Situations."
	☐	23.	**Stop**	Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 24. If the evaluation is not satisfactory, repeat steps 21 through 23.
Optional 📼	☐	24.	**View**	Videotapes entitled *Fire Extinguisher Training and Use 2000* and *Fire Protection/Electrical Safety.*
	☐	25.	**Observe**	Demonstration of procedures to be used in completing Job Sheet 2. Note: If possible, observe a member of your local fire department demonstrate the proper use of several types of fire extinguishers. When completing this job sheet, be sure to use the safe area that the fire department established to put out fires.
	☐	26.	**Do**	Job Sheet 2, "Operate a Fire Extinguisher."

☐ 27. **Stop** Have instructor evaluate your performance and if the evaluation is satisfactory, continue to step 28. If the evaluation is not satisfactory, study the procedure outlined in Job Sheet 2 and repeat steps 21, 25, 26, and 27.

☐ 28. **Check** With instructor for any additional assignments to be completed.

☐ 29. **Do** Additional assignments listed below.

____

____

____

☐ 30. **Take** Posttest provided by instructor. After test has been evaluated, follow instructor's recommendations.

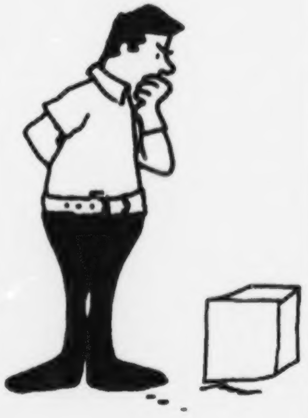
☐ 31. **Stop** Have instructor evaluate your unit performance. If the evaluation is satisfactory, proceed to next learning activities sheet. If evaluation is not satisfactory, ask instructor for further instructions.

***Permission to duplicate this form is granted.**

How to Lift Safely

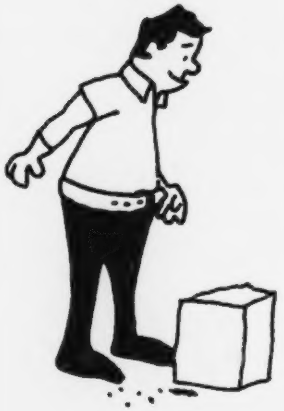
1

Approach the load and size it up as to weight, size, and shape. Consider your physical ability to handle the load.



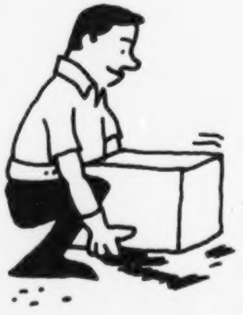
2

Place feet close to the object to be lifted and 8 to 12 inches apart for good balance.



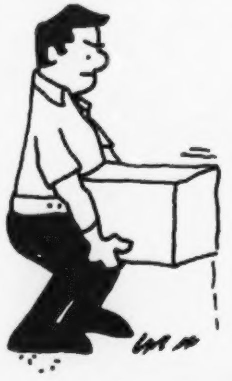
3

Bend the knees to the degree that is comfortable and get a good handhold. Then using both leg and back muscles. . .



4

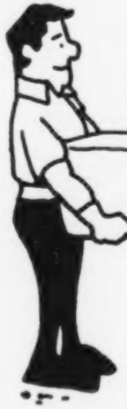
Lift the load straight up smoothly and evenly. Push with your legs, and keep the load close to your body.



How to Lift Safely (continued)

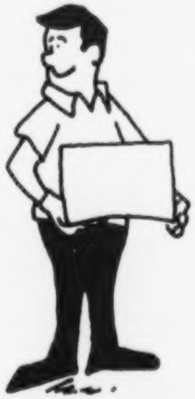
5

Lift the object into carrying position, making no turning or twisting movements until the lift is completed.



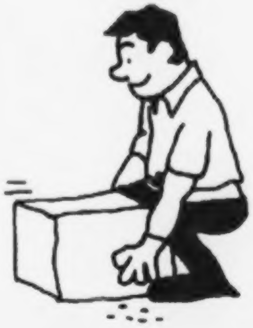
6

Turn your body with changes of foot position after looking over your path of travel, making sure it is clear.

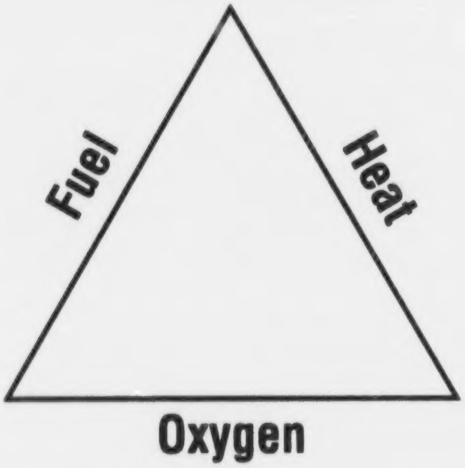


7

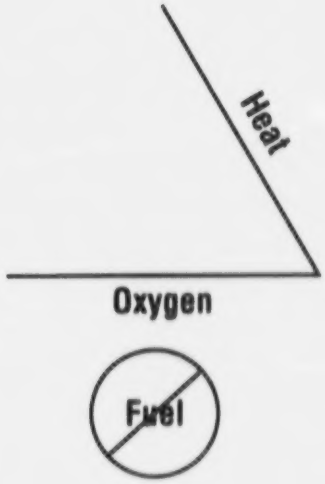
Setting the load down is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.

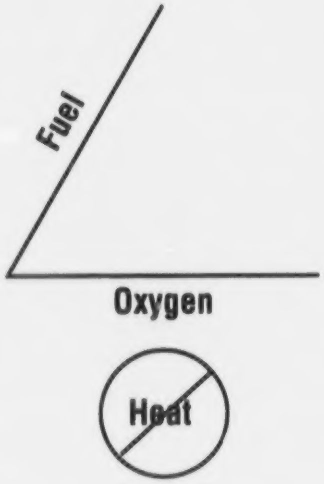


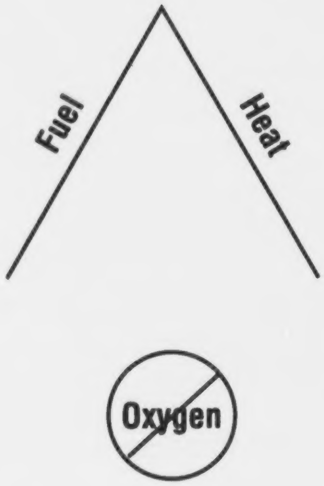
The Fire Triangle


Fuel
Heat
Oxygen

To produce fire, the three elements of the fire triangle must be present at the same time. If any one of the three is missing, a fire cannot be started. With the removal of any one element, the fire will be extinguished.


Heat
Oxygen
Fuel


Fuel
Oxygen
Heat


Fuel
Heat
Oxygen

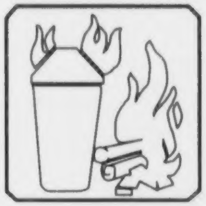
Classes of Fires

Class A

(Green)

A

- Ordinary combustibles

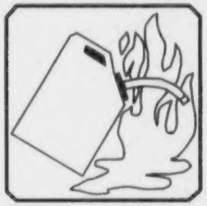


Class B

(Red)

B

- Flammable liquids and gases

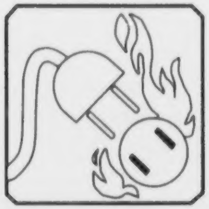


Class C

(Blue)

C

- Live electrical equipment

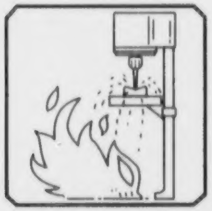


Class D

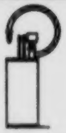
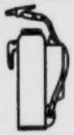
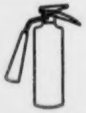
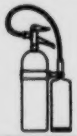
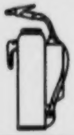
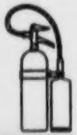
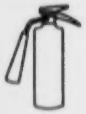
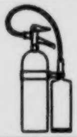
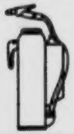
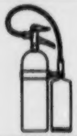
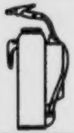
(Yellow)

D

- Combustilbe metals



Types of Fire Extinguishers

Type of Fire	Approved Type of Extinguisher				
	Pressurized Water	**Carbon Dioxide**	**Multi-Purpose Dry Chemical**	**Halon Gas**	**Foam**
Class A Fires **ORDINARY COMBUSTIBLES** • Wood • Paper • Cloth, etc.					
Class B Fires **FLAMMABLE LIQUIDS, GREASE** • Gasoline • Paints • Oils, etc.					
Class C Fires **ELECTRICAL EQUIPMENT** • Motors • Switches, etc.					
Class D Fires **COMBUSTIBLE METALS** • Magnesium • Phosphorus • Iron					

Unit 2 Workplace Safety

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2—Compile a List of Hazardous Materials Found in Your Shop and Provide Additional Information on the Most Common Materials 2–33
3—Apply the Safety Color Codes to Diesel Technology Shops . . . 2–35
4—Identify Workplace Safety Violations 2–37
5—Complete an Individual Student Shop Safety Inspection 2–39

Suggested Activities

Instructional Plan

Preparation

- Read the unit carefully and plan for instruction.
- Review "Teaching Suggestions." Plan for classroom activities.
- Plan your presentation to take advantage of student learning styles and to accommodate special-needs students.
- Prepare classroom. Put up posters and charts and display articles and other references related to this unit.
- Obtain films, videotapes, and other resources to supplement instruction of this unit. See "Resources Used in Developing This Unit" and "Suggested Supplemental Resources" for more information.
- For self-paced instruction, review Learning Activities Sheet. Modify as appropriate to include additional activities and/or resources available in your classroom. Make one copy for each student.
- Make transparencies from the transparency masters included in this unit. These appear in the teacher edition only.

Delivery and Application

Unit Introduction (self-paced instruction)

- Provide student with Learning Activities Sheet and unit of instruction.
- Review unit contents with student.
- Have the student complete the steps in the learning activities sheet.

Unit Introduction (group instruction)

- Provide students with unit of instruction.
- Discuss unit and specific objectives.
- Discuss the information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.
- Discuss the assignment sheets. Review with students the criteria for evaluation of these activities.

Suggested Activities

Teaching Suggestions

- Discuss the role of the federal government in workplace safety and environmental safety. Discuss how OSHA, EPA, DOT, and other federal agencies work to ensure a basic level of safety across the country. Also discuss the role of your state government as it relates to workplace safety. Have students discuss the pros and cons of government involvement in enforcing workplace safety.
- Display safety rules and safety posters as they apply to the diesel technology workplace. The OSHA "You Have a Right to a Safe and Healthful Workplace" poster (OSHA 3165) should also be displayed.
- Show examples of chemical labels in your shop. Point out the different types of information found on a chemical label. (Objective 5) You could develop quizzes over the labels available in the diesel shop.
- Show examples of actual material safety data sheets. Point out different types of arrangements. (Objective 6 and Student Supplement 1) An example is given in Assignment Sheet 1. Let students know where these MSDSs will be kept in the shop. They should be readily accessible to all students.
- Assist students in compiling a list of the hazardous materials in your shop and in deciding which are the most commonly used hazardous materials for Assignment Sheet 2.
- Discuss accidents you have seen or been involved in with hazardous materials. Discuss the long term and short term effects. Discuss what should be done in case of an accident or spill. This will vary depending on the type of material. Have students refer to the MSDS for more information on accidents and spills.
- While students are looking at labels and MSDS, have them note the diamond classification system if it is used. (Objective 10) Have them identify the hazardous levels of materials based solely on the diamonds. Then have them read the labels or MSDS for more information that confirms the diamond numbers (0–4).
- Discuss how hazardous waste materials are stored, handled, and disposed of in your shop. Point out the storage and disposal containers.
- Show examples of the safety tags that are used in your shop. Review how these are to be used.
- Show the brake and clutch cleaning equipment used in your shop. Review how this is to be used.
- Demonstrate the proper use of the lifting equipment used in your shop. Also show equipment and vehicle stands and jacks. Review safety precautions.

- You may also want to demonstrate the exhaust removal equipment used in your shop at this time.
- Assignment Sheet 5 could be used as a group activity. You could conduct the tour of the shop, and students could complete the inspection during the tour.

Evaluation

- Make copies of the written test. Add or modify test items as needed. The written test serves as both a pretest and posttest to assist in measuring each student's competency gains.
- Give and evaluate pretest. Modify lesson plan to include additional instruction for those areas where students were deficient.
- Evaluate the assignment sheets. Rate the student using the criteria listed on each assignment sheet. See Answers to Assignment Sheets for correct answers where applicable. If the student's performance is unacceptable, have the student review the appropriate materials and complete the assignment again.
- Give and evaluate the posttest.
- Meet individually with students to evaluate their progress through this unit of instruction and indicate to them possible areas of improvement.
- Reteach and retest as required.

Resources Used in Developing This Unit

Print Media

- *Hazardous Waste Management for the Small Quantity Generator.* Stillwater, OK: CIMC/Oklahoma Department of Career and Technology Education, 1989.
- *Hazardous Waste Regulations Pertaining to the Disposal of Waste from Clayton Brake Washers Using the CareFree Disposal System™.* Lakewood, NJ: Clayton Associates, Inc., 1994.
- Landberg, Lynn, senior editor. "Getting Your Clean-Air Act Together." *Tech Tips* (May 1994). Equipment Maintenance Council.
- Norman, Andrew and Robert Scharff. *Heavy-Duty Truck Systems.* New York: Delmar Publishers, Inc., 1991.
- *OSHA Compliance Encyclopedia.* 3 volumes. Madison, CT: Business and Legal Reports, Inc., 1994.
- *Safety and Health.* San Francisco: Parlay International.
- *Safety on the Job: Some Guidelines for Working Safely.* Stillwater, OK: CIMC/Oklahoma Department of Career and Technology Education, 1989.

- Warzecha, Mary. *Hazardous Materials Fingertip Retrieval System.* Alexandria, VA: American Vocational Association, 1988.

Suggested Supplemental Resources

Print Media

- Fact sheet—*Complying With the Section 608 Refrigerant Recycling Rule*

  For more information, contact:

  MVACs Recycling Program Manager
  Stratospheric Ozone Protection Branch (6202J)
  US EPA
  Mail Code 6205J
  401 M St., SW
  Washington, DC 20460
  Information Hotline: 800-296-1996
  http://www.epa.gov/spdpublc/

- OSHA Fact Sheets

  — *Control of Hazardous Energy Sources (Lock-out/Tagout)*, 89-32

  — *Carbon Monoxide Poisoning*, 92-11

  — *Better Protection Against Asbestos in the Workplace*, 93-06

  — *Hazard Communication Standard*, 93-26

  — *OSHA: Employee Workplace Rights and Responsibilities*, 93-35

  The fact sheets listed above are available from regional OSHA offices, the OSHA Web site, or from:

  U.S. Department of Labor
  Occupational Safety and Health Administration (OSHA)
  200 Constitution Avenue, N.W.
  Washington, D.C. 20210
  http://www.osha-slc.gov/OshDoc/Fact_toc/Fact_toc_by_num.html

Electronic Media

- Internet Resource

  www.motor.com—Motor Publications Web site has links to Motor Magazine, source guide to products, training, automotive associations, etc.

- Videos

The following videos are also available as CD-ROMs. The CDs allow students to take a test with full tracking of how many questions were answered correctly or incorrectly.

— *Hand and Power Tool Safety for Automotive Mechanics* (12 minutes)—Good introduction to hand and power tool safety. Explains procedure for tool safety, housekeeping, and other safety procedures. (D44007)

— *Motor Fleet Maintenance Safety* (18 minutes)—Addresses hazards associated with vehicle maintenance and repair. Explains basic tools, electrical hand tool, fire hazards, and more. (D42007)

— *Hazard Communications* (16 minutes)—Meets OSHA's "right to know" requirements. Explains material safety data sheets, labels, and general information on using or handling hazardous materials. (D36007)

— *Fleet Shop Safety and Hazardous Materials* (6 minutes)—Addresses hazardous materials and safety issues common to automotive shops. It specifically targets material safety data sheets, chemicals, asbestos, and safety procedures. (D45007)

— *Vehicle Lockout/Tagout Procedures* (16 minutes)—This is a training tool for "affected" and "authorized" employees training on control of hazardous energy sources when servicing or working near vehicle being serviced. (D19007)

To order the videos or CD-ROMs listed above, contact:

MAVCC
1500 West Seventh Avenue
Stillwater, OK 74074
Sales: 1-800-654-3988
www.mavcc.org
E-mail: mavcc@mavcc.com

Answers to Assignment Sheets

Assignment Sheet 1

Interpret a Material Safety Data Sheet

1. Gel Graffiti
2. An engine degreaser
3. Ethanol, aromatic hydrocarbon, chlorinated hydrocarbon, glycol ethers
4. Opaque, white gel
5. 77
6. Carbon dioxide (CO_2) and foam
7. Container may rupture
8. 50 ppm
9. Yes. Chlorinated hydrocarbon has produced cancer in animal studies. (NTP Program)
10. Inhalation
11. Headaches, dizziness, irritation, burning eyes, nausea, asphyxia, and possible chemical pneumonitis if aspirated into lungs
12. The victim should NOT be induced to vomit.
13. Heat, sparks, welding arc, open flames
14. Strong oxidizing agents
15. Absorb with suitable medium. Incinerate or landfill according to local, state, or federal regulations. Do not flush to sewer.
16. Safety glasses, neoprene gloves, and adequate ventilation or respirator if concentration exceeds TLV
17. Wash with soap and water before handling food.

Assignment Sheet 2

Compile a List of Hazardous Materials Found in Your Shop and Provide Additional Information on the Most Common Materials

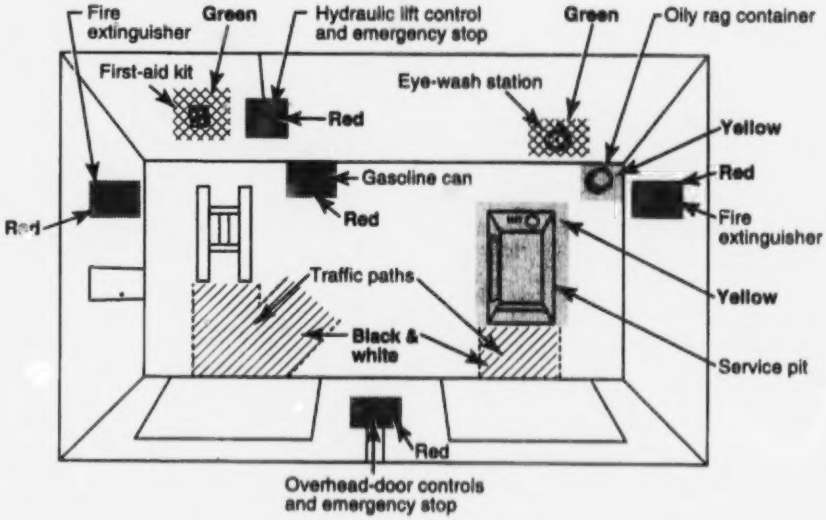
Evaluate according to the criteria listed on the assignment sheet and as appropriate for your school shop.

Answers to Assignment Sheets

Assignment Sheet 3

Apply the Safety Color Codes to Diesel Technology Shops

Part A: Given Shop

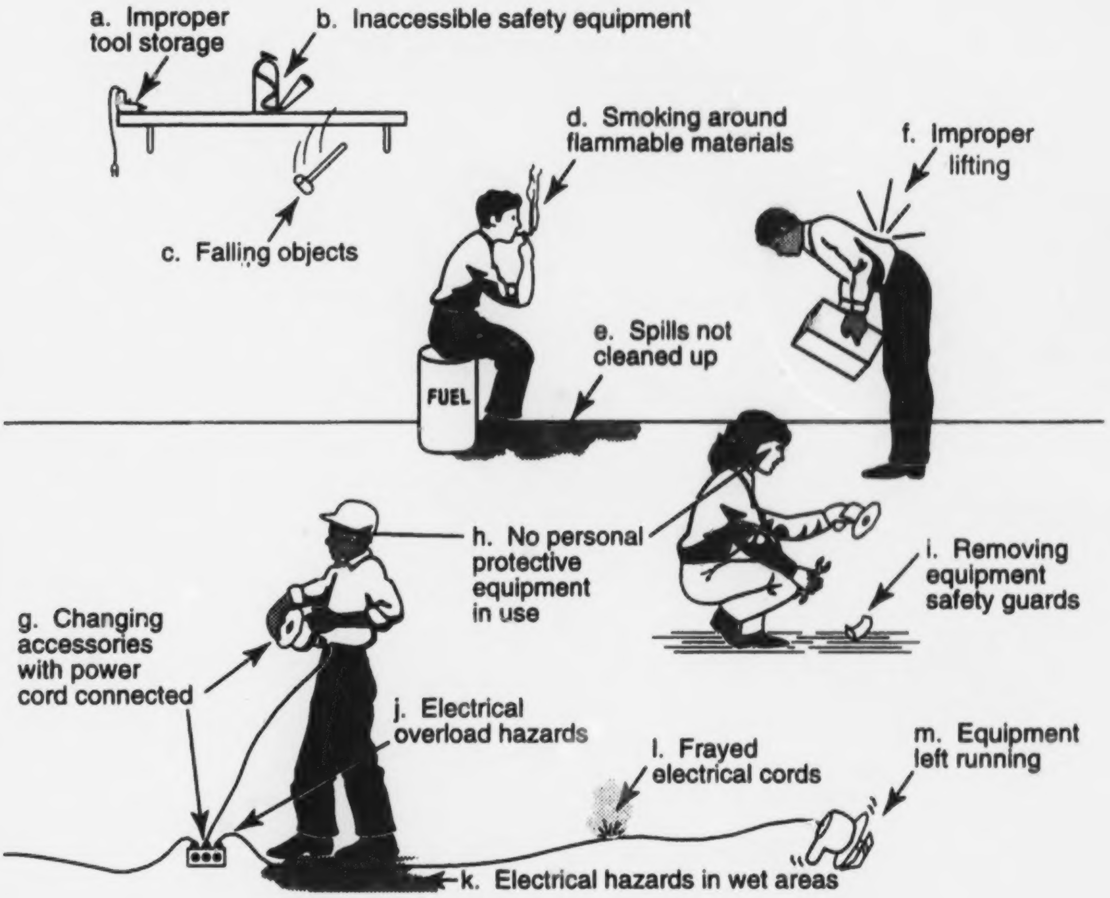

Fire extinguisher
Green
Hydraulic lift control and emergency stop
Green
Oily rag container
First-aid kit
Red
Eye-wash station
Yellow
Red
Gasoline can
Red
Red
Fire extinguisher
Traffic paths
Yellow
Black & white
Service pit
Red
Overhead-door controls and emergency stop

Part B: School shop—Evaluate according to the criteria listed on the assignment sheet and as appropriate for your school shop.

Answers to Assignment Sheets

Assignment Sheet 4

Identify Workplace Safety Violations—At least eight of the following:


a. Improper tool storage
b. Inaccessible safety equipment
c. Falling objects
d. Smoking around flammable materials
e. Spills not cleaned up
f. Improper lifting
FUEL
g. Changing accessories with power cord connected
h. No personal protective equipment in use
i. Removing equipment safety guards
j. Electrical overload hazards
l. Frayed electrical cords
m. Equipment left running
k. Electrical hazards in wet areas

Assignment Sheet 5

Complete an Individual Student Shop Safety Inspection—Evaluate according to the criteria listed on the assignment sheet and as appropriate for your school shop.

Written Test

Name ____

Date ________________________________ Score__________

Objective 1

Match the terms with their definitions. Definitions continue on the next page.

1. Carbon monoxide
2. Combustible
3. Conductor
4. Corrosive/caustic
5. Electricity
6. Environmental Protection Agency (EPA)
7. Exposure
8. Exposure limit
9. Flammable
10. Flash point
11. Grounded
12. Hazardous material
13. Hazardous waste
14. Insulator
15. Material safety data sheet (MSDS)
16. Occupational Safety and Health Act (OSHA)
17. Reactive
18. Solvent
19. Toxic
20. Volatile

_____ a. Temperature at which a substance will catch fire

_____ b. Unwanted by-products that are ignitable, corrosive, reactive, or toxic

_____ c. Electrical connection to an object that conducts electrical current to the earth

_____ d. Form that explains a hazardous material that an employee works with so the employee can safely use the material and respond to emergency situations

_____ e. Colorless, odorless, poisonous gas formed by incomplete combustion

_____ f. Material that does not allow the transmission of electricity

_____ g. Chemical that dissolves another substance

_____ h. Capable of bursting into flames at temperatures above 100°F

_____ i. Any substance that could cause injury or death to a person or damage to the environment

_____ j. Capable of causing illness or death after exposure, even at very low levels

_____ k. Readily vaporized at a relatively low temperature

_____ l. Capable of burning, exploding, or giving off harmful vapors if mixed with air, water, heat, or other materials

_____ m. Federal legislation designed to ensure safe and healthful working conditions for employees

_____ n. Unprotected contact with a harmful substance

_____ o. Material that allows the transmission of electricity

_____ p. Federal agency designed to protect our natural resources (air, water, soil, plants, animals, etc.) from contamination due to hazardous and toxic substances

_____ q. Capable of being easily ignited and burning quickly at temperatures below 100°F

_____ r. Capable of dissolving metals and/or burning skin and eyes

_____ s. Level of a material you can be exposed to each day with no adverse effects

_____ t. Fundamental entity of nature usually used as electrical current

Objective 2

Distinguish among the federal agencies that regulate hazardous materials and hazardous waste by placing the following letters next to the correct descriptions.

DOT EPA OSHA

_____ a. Regulates the disposal of hazardous waste

_____ b. Regulates the transportation of hazardous materials

_____ c. Regulates hazards in the workplace, including worker exposure to hazardous materials

Objective 3

Complete statements concerning OSHA's role in workplace health and safety by circling the correct answers.

a. The Occupational Safety and Health Act was signed on December 29, **(1950) (1970)**.

b. The U.S. Department of **(Education) (Labor)** created the Occupational Safety and Health Administration (OSHA) to oversee the Act.

c. OSHA **(does) (does not)** issue standards and rules for safe and healthful working conditions, tools, equipment, facilities, and processes.

d. OSHA **(does) (does not)** conduct workplace inspections to assure that standards are followed.

e. OSHA sets two major requirements for employers—to provide work and a workplace free from recognized hazards, and to comply with **(OSHA regulations) (IRS guidelines)**.

Objective 4

Complete statements concerning hazard communication by filling in the blanks with the correct answers.

a. OSHA established the Hazard Communication Standard to protect the health and safety of ______________________________.

b. This standard states that employees have both a need and a " ________ ________________" the hazards and the identities of the chemicals they are exposed to when working.

c. Employees also need to know what ______________________ are available to prevent adverse effects from occurring.

d. OSHA requires employers to develop a written HazCom program including:

- Warning labels on containers
- ______________________________
- Employee training on the proper handling, usage, storage, and transportation of chemicals

Objective 5

Describe at least four types of information on a chemical label.

a. ______________________________

____

b. ______________________________

____

c. ______________________________

____

d. ______________________________

____

Objective 6

Complete statements concerning purposes of a material safety data sheet (MSDS). Write the correct number on the blank provided before each item.

_____ a. To inform ______________ of the material's physical properties or fast-acting health effects that make it dangerous to handle

1) OSHA
2) the management
3) the user
4) the health department

_____ b. To tell the user the level of ____________________ needed

1) protective gear
2) medical care
3) hygiene
4) management

_____ c. To tell the user the ______________________ necessary if exposed to the product or its hazards

1) preplanning
2) OSHA regulations
3) legal actions
4) first aid treatment

_____ d. To tell the management and the user the ________________ needed for safely handling spills, fires, and day-to-day operations

1) legal actions
2) preplanning
3) equipment and materials
4) personnel resources

_____ e. To tell the user how to __________________ accidents

1) report
2) respond to
3) prevent
4) record

Objective 7

List the four characteristics of a hazardous material.

a. ____

b. ____

c. ____

d. ____

Objective 8

List three ways hazardous materials can enter the body.

a. ____

b. ____

c. ____

Objective 9

Distinguish between the short-term and long-term health effects from exposure to hazardous materials by placing an "S" or "L" next to the correct descriptions and examples.

_____ a. Examples include pain, nausea, itching skin, burning eyes, headache, and vomiting

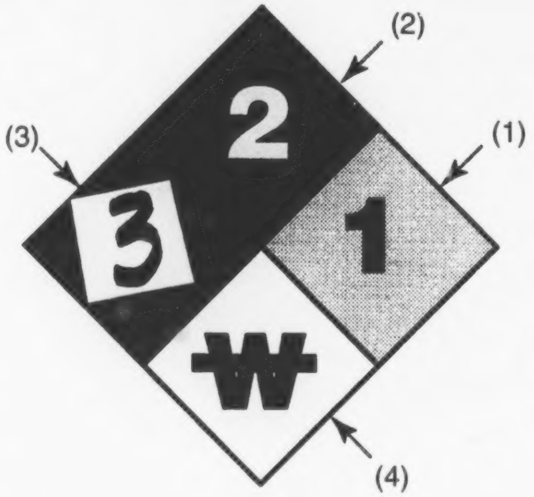
_____ b. Examples include cancer, asbestosis, emphysema, sterility, and kidney damage

_____ c. Severe, ongoing illness resulting from repeated or prolonged encounters with a chemical

_____ d. Minor symptoms resulting from a brief encounter with a chemical

Objective 10

Identify hazards using the hazardous materials diamond classification system.



a. What color is the #1 diamond and what hazard does it represent?

______________________, ______________________

b. What color is the #2 diamond and what hazard does it represent?

______________________, ______________________

c. What color is the #3 diamond and what hazard does it represent?

______________________, ______________________

d. For the #4 diamond, what color would the letters or symbols be?

____

e. What does a rating of 4 mean? ______________________

f. What does a fire rating of 0 mean? ______________________

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Written Test

g. What does the symbol ₩ mean? ______________________________

h. What does the abbreviation OXY mean? ________________________

Objective 11

Complete the following chart of hazardous materials that may be found in the diesel technology shop listing one name, use, or danger as appropriate.

Hazardous Material	Common Uses	Dangers
Asbestos	a.	b.
Benzene	Used in many solvents and in some motor fuels	c.
Carbon monoxide, nitrous oxide, and other exhaust fumes	Unwanted waste products of internal combustion engines	d.
Ether, ethyl, and its compounds	e.	Avoid all contact and inhalation. Can damage skin, eyes, lungs, and nervous system.
f.	Used as fuels, solvents, thinners, additives, sealant, and lubricants	Avoid contact and inhalation. Can damage skin, eyes, and nervous system. Also use extreme care because all are a fire hazard.
Lead	g.	May be formed into metal dust when cutting or grinding on products made of this toxic heavy metal. Avoid breathing this dust. Can cause severe damage to the nervous system.
Sulfuric acid	h.	Avoid contact and inhalation. Can damage skin, eyes, lungs, and nervous system.

Objective 12

Select from the following list the hazardous waste products associated with the diesel technology shop by placing an "X" in the appropriate blanks.

_____ a. Contaminated food

_____ b. Contaminated fuel

_____ c. Contaminated water

_____ d. Waste antifreeze

_____ e. Waste caustic/corrosive

_____ f. Waste medical products

_____ g. Waste oil

_____ h. Waste pesticides

_____ i. Waste solvent

Objective 13

Complete statements concerning guidelines for storing and disposing of hazardous materials by filling in the blanks with the correct answers.

a. Store and dispose of hazardous materials according to the _____________ _______________________ and your school/company policies.

b. Store flammable/combustible materials separate from _______________.

c. Store hazardous materials in _______________________ cabinets.

d. Never pour hazardous materials into/onto ___________________.

e. The _______________________________ monitors hazardous waste disposal to make sure that several environmental laws passed by Congress are followed properly.

f. Most hazardous waste products are sent to _________________________ for disposal. Waste water must be pretreated and then sent to a municipal sewer system.

g. The EPA has established guidelines to comply with the Clean Air Act for the recovery and recycling of motor vehicle ___________________________. EPA-approved equipment must be used by trained and certified technicians.

Written Test

Objective 14

Distinguish between true and false statements concerning guidelines for using flammable materials and toxic substances. Place a "T" or "F" as appropriate.

_____ a. If your hair or clothing catches fire, run to the nearest exit or report to your supervisor.

_____ b. Carefully read and follow container label directions before using any flammable liquids or toxic substances. Refer to the MSDS for more detailed information.

_____ c. Wear personal protective equipment (PPE) as specified on the MSDS to prevent eye and skin contact.

_____ d. Use flammable and toxic chemicals in tightly closed areas without fresh air sources.

_____ e. Avoid breathing toxic fumes or gases.

_____ f. Use a water type fire extinguisher on all flammable and toxic chemical fires.

_____ g. Smoking and welding is allowed around corrosives and reactives, but not flammables.

Objective 15

Complete statements concerning equipment and tool safety guidelines by circling the correct answers.

a. Always wear **(eye) (respiratory)** protection while grinding and drilling.

b. Remove **(clothes) (jewelry)** when operating power equipment.

c. Secure **(long) (short)** hair and loose clothing such as ties, scarves, or wide sleeves when working around power equipment.

d. Obey all safety rules and operating instructions provided by the equipment manufacturer, plus any additional ones used by your **(mother) (shop)**.

e. Keep tools and equipment **(oily) (clean)** and in safe working order.

f. Properly store tools and equipment when **(in use) (not in use)**.

g. **(Keep) (Remove)** guards and safety devices on all equipment.

h. **(Tag) (Discard)** and report to the supervisor/instructor any defective tools, machines, or equipment.

i. **(Turn off) (Unplug)** power equipment when not in use.

j. Operate equipment **(before) (after)** receiving training on how to use it properly and safely.

k. **(Never) (Always)** use compressed air to clean yourself or your clothing.

l. Practice this tool motto: "Get, use, and **(put) (throw)** away."

Objective 16

Complete statements concerning electrical safety guidelines by filling in the blanks with the correct answers.

a. Do not use any electrical appliance or equipment while you are touching ______________________________.

b. Before performing a maintenance task on electrical equipment, disconnect the power and ______________________ machine tools (if trained).

c. Keep electrical equipment and work areas ______________________ to prevent electrical fires. Electrical sparks could ignite any flammable material nearby.

d. Keep access to electrical panels and junction boxes ______________.

e. Keep flammable materials away from ______________________________.

f. Know the location of fuses and ______________________________.

g. Plug power tools into grounded outlets installed with ______________.

h. Never use ______________________ on electrical fires.

i. Name at least one unsafe electrical condition or item that should be reported to your instructor or supervisor immediately. ______________

____

Objective 17

Match the colors of the federal safety color code with their uses.

1. Black and white
2. Blue
3. Green
4. Orange
5. Purple
6. Red
7. Yellow

_____ a. Indicates caution; physical hazards; waste containers for explosive or combustible materials; equipment that should not be started, used, or moved; and starting point or power source for machinery

_____ b. Identifies fire protection equipment; portable containers of flammable liquids; and emergency stop bars, stop buttons, and electrical stop switches on machinery

_____ c. Identifies first aid equipment

_____ d. Identifies dangerous parts of equipment that could cut, crush, shock, or otherwise injure; indicates safety starter buttons

_____ e. Indicates traffic flow paths, storage areas, and housekeeping areas

_____ f. Indicates radiation hazards

_____ g. Identifies tags that indicate equipment that should not be started, used, or moved

Written Test

Objective 18

Match the types of safety tags with their color coding.

1. Caution tag
2. Danger tag
3. Do not start tag
4. Out of order tag

_____ a. White tag, white letters on red square

_____ b. White tag, white letters on red oval, on black square

_____ c. Yellow tag, yellow letters on black square

_____ d. White tag, white letters on black square

Objective 19

Complete statements concerning general safety guidelines for working on vehicles by circling the correct answers.

a. Be sure vehicle is **(in gear) (out of gear)** before starting it.

b. Use extreme caution when moving a vehicle in the shop. Check around the vehicle and the planned path to make sure there are no **(obstacles) (fires)** in the way.

c. Use a **(rear-view mirror) (spotter)** to help you if trying to maneuver or park a vehicle in a close area.

d. **(Do) (Do not)** leave a vehicle running in the shop without adequate exhaust-removal equipment in place.

e. Avoid moving parts on the vehicle, such as **(fans) (frame)**.

f. Avoid parts that heat up during engine operation, such as **(tires) (exhaust pipes)**.

g. **(Do) (Do not)** allow tools or other metal objects to contact both battery terminals at the same time.

h. Wear **(gloves) (hearing protection)** when handling batteries.

i. Wear your **(safety glasses) (safety belt)** whenever you ride in or drive a vehicle, including test drives—no matter how short.

Objective 20

Complete statements concerning an overview of asbestos and guidelines for reducing asbestos exposure by filling in the blanks with the correct answers.

a. Asbestos is the name of a class of magnesium-silicate minerals that occur in

_____________________________ form.

b. Asbestos can cause disabling respiratory disease and various types of

_________________________________ if the fibers are inhaled. Symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

c. Name at least one OSHA recommendation to reduce asbestos exposure to levels below the PEL. ______________________________

____

d. Name one of the two OSHA preferred methods for brake and clutch inspection, disassembly, repair, and assembly in the diesel technology shop. __________

____

e. Every effort should be made in the shop to prevent asbestos fibers from becoming

______________________________.

*Permission to duplicate this test is granted.

Answers to Written Test

Objective 1

a. 10
b. 13
c. 11
d. 15
e. 1
f. 14
g. 18
h. 2
i. 12
j. 19
k. 20
l. 17
m. 16
n. 7
o. 3
p. 6
q. 9
r. 4
s. 8
t. 5

Objective 2

a. EPA
b. DOT
c. OSHA

Objective 3

a. 1970
b. Labor
c. Does
d. Does
e. OSHA regulations

Objective 4

a. Employees (workers)
b. Right-to-know
c. Protective measures (students may give specific examples)
d. Material Safety Data Sheets (MSDS) readily available to employees

Objective 5

Any four of the following:

a. Chemical name and ingredients
b. Name, address, and phone number of the manufacturer or distributor
c. Procedures for usage, handling, storage, and disposal
d. How to handle spills and leaks
e. Signal words identifying chemical as hazardous
   - Caution—Least severe
   - Warning—Very severe
   - Danger—Most severe
f. Critical first aid instructions and type of fire extinguisher to use
g. Personal protective equipment to wear when using the chemical
h. Other information about the chemical
   - Flammability
   - Radioactivity
   - Reactivity—Uses words "incompatible," "unstable," and "volatile"
   - Toxicity

Objective 6

a. 3
b. 1
c. 4
d. 2
e. 2

Answers to Written Test

Objective 7

a. Flammable
b. Corrosive
c. Reactive
d. Toxic

Objective 8

a. Ingestion—Swallowing by mouth
b. Absorption—Contacting the skin or eyes
c. Inhalation—Breathing in gases, vapors, fumes, or other airborne forms of a material

Objective 9

a. S
b. L
c. L
d. S

Objective 10

a. Yellow, reactivity
b. Red, fire
c. Blue, health
d. Black
e. Severe hazard
f. Will not burn
g. Use no water
h. Oxidizer

Objective 11

Students should list at least one name, use, or danger for each.

a. Used as fireproofing insulation in clutch and brake linings and pads
b. Do not inhale asbestos dust. Can cause serious long-term lung damage and disease.
c. Avoid all contact and inhalation. Can damage skin, eyes, and nervous system.
d. Avoid inhalation. Fumes interfere with body's use of oxygen. Can cause death by suffocation.
e. Used in antifreeze, several solvents, starting fluids, and some fuel additives
f. Flammable and combustible liquids, including all products containing petroleum or alcohol
g. Used in pipes, cables, batteries, radiators, and solder
h. Used in battery electrolyte

Objective 12

b, c, d, e, g, i

Objective 13

a. MSDS
b. Corrosives or reactives
c. Locked or metal
d. Into the drain, sewer, or garbage can, or onto the ground
e. Federal government or EPA
f. Recyclers
g. Air conditioning refrigerants

Answers to Written Test

Objective 14

a. F
b. T
c. T
d. F
e. T
f. F
g. F

Objective 15

a. Eye
b. Jewelry
c. Long
d. Shop
e. Clean
f. Not in use
g. Keep
h. Tag
i. Turn off
j. After
k. Never
l. Put

Objective 16

a. Metal or water
b. Tag or lockout
c. Clean
d. Clear (unobstructed)
e. Heat or electrical heat sources
f. Circuit breakers
g. Ground fault circuit interrupters (GFCIs)
h. Water
i. Any one of the following:
  - Defective, frayed, or damaged cords
  - Shocking, sparking, overheating, or smoking equipment
  - Corroded or broken switches or outlets
  - Extension cords in permanent use

Objective 17

a. 7
b. 6
c. 3
d. 4
e. 1
f. 5
g. 2

Objective 18

a. 3
b. 2
c. 1
d. 4

Objective 19

a. Out of gear
b. Obstacles
c. Spotter
d. Do not
e. Fans
f. Exhaust pipes
g. Do not
h. Gloves
i. Safety belt

Answers to Written Test

Objective 20

a. Fibrous
b. Cancers
c. Any one of the following:
  - Engineering controls (including approved brake cleaning equipment)
  - Exposure monitoring
  - Respirators and protective clothing
  - Hygiene facilities (clean change rooms, lockers, and showers)
  - Warning signs and labeling
  - Recordkeeping and medical exams
d. Either one of the following:
  - Negative pressure enclosure with HEPA (high efficiency particulate air) vacuum system
  - Low pressure/wet cleaning brake cleaning equipment
e. Airborne

Prerequisites:
None

Learning Activities Sheet

Student Name ______________________________

Place a checkmark in the appropriate box as you complete each of the steps below.

☐ 1. **Take** Pretest provided by instructor. After test has been evaluated, follow instructor's recommendations.

☐ 2. **Read** Objective Sheet.

☐ 3. **Study** Information Sheet, Objectives 1 through 5.

Optional ☐ 4. **View** Videotape entitled *Hazard Communications.*

☐ 5. **Study** Information Sheet, Objective 6 and Student Supplement 1.

Optional ☐ 6. **View** Videotape entitled *Fleet Shop Safety and Hazardous Materials.*

☐ 7. **Do** Assignment Sheet 1, "Interpret a Material Safety Data Sheet."

☐ 8. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 9. If the evaluation is not satisfactory, repeat steps 5, 7, and 8.

☐ 9. **Study** Information Sheet, Objective 7 through 11.

Optional ☐ 10. **View** Videotape entitled *Motor Fleet Maintenance Safety.*

☐ 11. **Do** Assignment Sheet 2, "Compile a List of Hazardous Materials Found in Your Shop and Provide Additional Information on the Most Common Materials."

Learning Activities Sheet

☐ 12. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 13. If the evaluation is not satisfactory, repeat steps 9, 11, and 12.

☐ 13. **Study** Information Sheet, Objectives 12 through 15.

Optional

☐ 14. **View** Videotape entitled *Hand and Power Tool Safety for Automotive Mechanics.*

☐ 15. **Study** Information Sheet, Objectives 16 through 17.

Optional

☐ 16. **View** Videotape entitled *Vehicle Lockout/Tagout Procedures.*

☐ 17. **Do** Assignment Sheet 3, "Apply the Safety Color Codes to Diesel Technology Shops."

☐ 18. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 19. If the evaluation is not satisfactory, repeat steps 15, 17, and 18.

☐ 19. **Study** Information Sheet, Objectives 18 through 20.

☐ 20. **Do** Assignment Sheet 4, "Identify Workplace Safety Violations."

☐ 21. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 22. If the evaluation is not satisfactory, repeat and steps 19 through 21.

☐ 22. **Do** Assignment Sheet 5, "Complete an Individual Student Shop Safety Inspection."

☐ 23. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 24. If the evaluation is not satisfactory, repeat and steps 19, 22, and 23.

☐ 24. **Check** With instructor for any additional assignments to be completed.

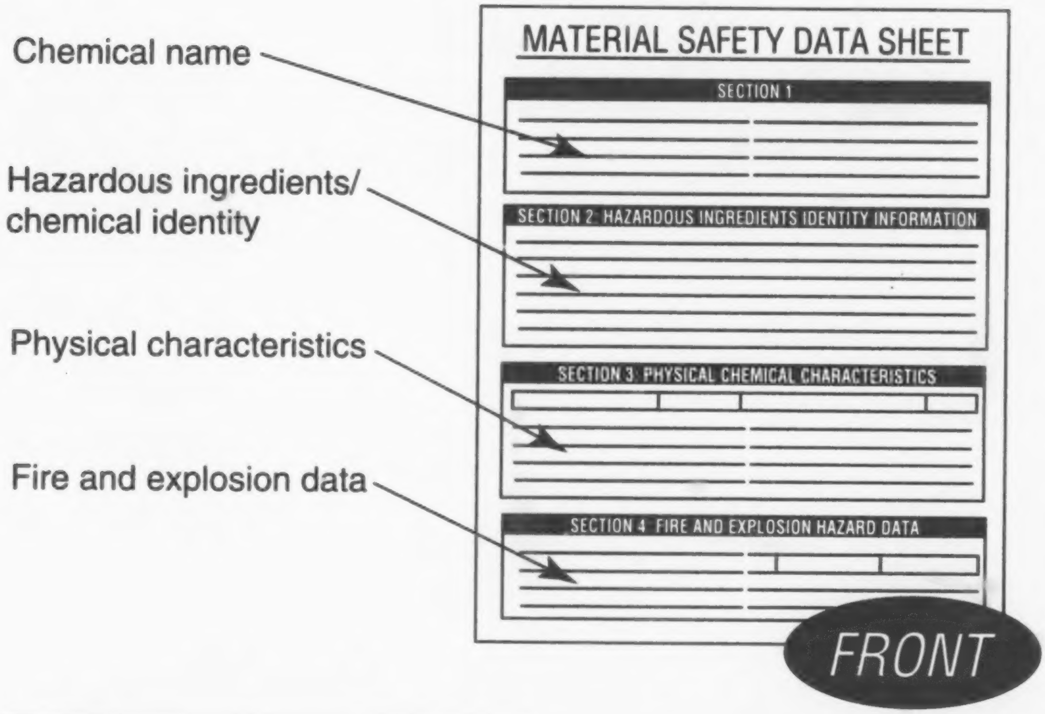
☐ 25. **Do** Additional assignments listed below.

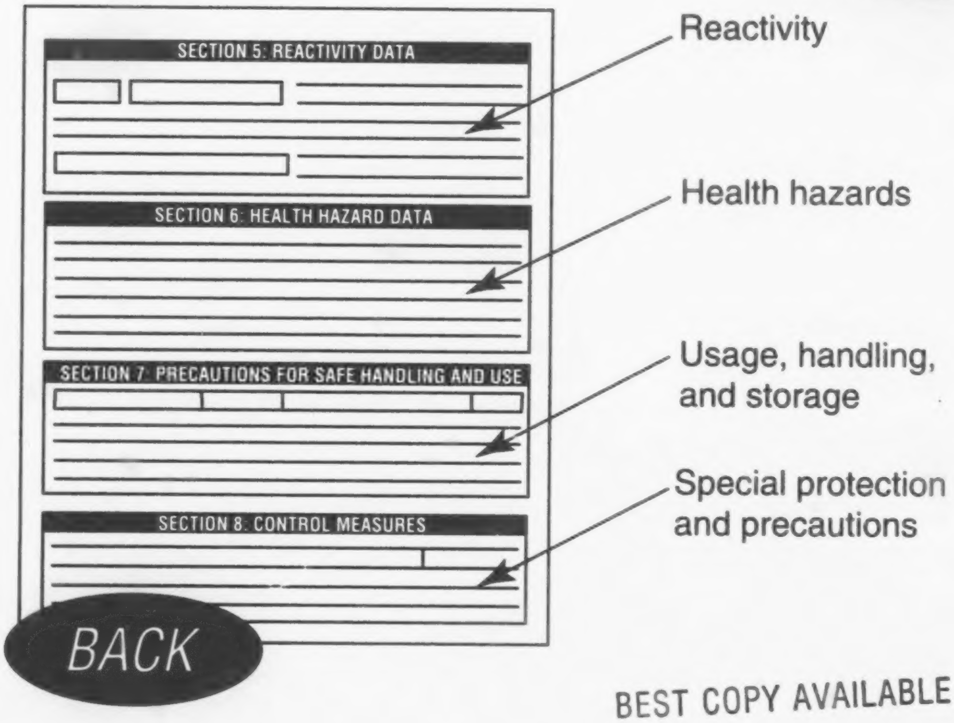
☐ 26. **Take** Posttest provided by instructor. After test has been evaluated, follow instructor's recommendations.

☐ 27. **Stop** Have instructor evaluate your unit performance. If the evaluation is satisfactory, proceed to next learning activities sheet. If evaluation is not satisfactory, ask instructor for further instructions.

***Permission to duplicate this form is granted.**

MSDS Example


Chemical name
Hazardous ingredients/ chemical identity
Physical characteristics
Fire and explosion data
MATERIAL SAFETY DATA SHEET
SECTION 1
SECTION 2 HAZARDOUS INGREDIENTS IDENTITY INFORMATION
SECTION 3 PHYSICAL CHEMICAL CHARACTERISTICS
SECTION 4 FIRE AND EXPLOSION HAZARD DATA
FRONT


SECTION 5: REACTIVITY DATA
SECTION 6: HEALTH HAZARD DATA
SECTION 7: PRECAUTIONS FOR SAFE HANDLING AND USE
SECTION 8: CONTROL MEASURES
BACK
Reactivity
Health hazards
Usage, handling, and storage
Special protection and precautions

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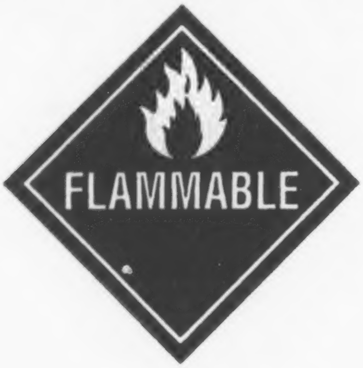
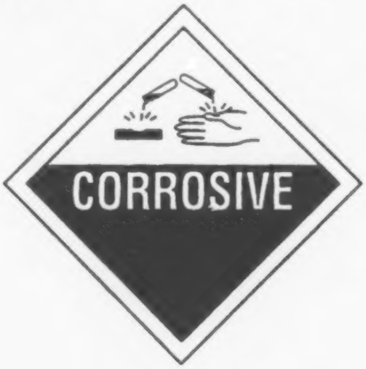
Characteristics of a Hazardous Material

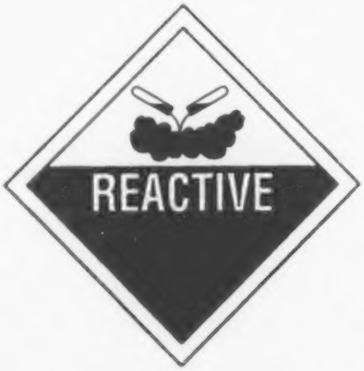
*If the MSDS or chemical label lists any of these characteristics, then the material is considered hazardous.



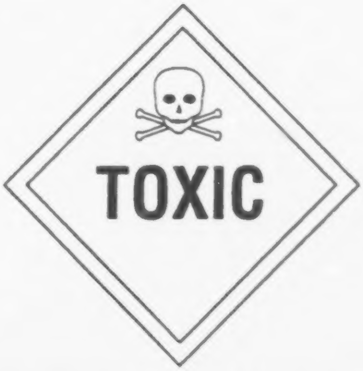
Capable of being easily ignited and burning quickly at temperatures below 100°F; can explode



Capable of dissolving metals and/or burning skin and eyes

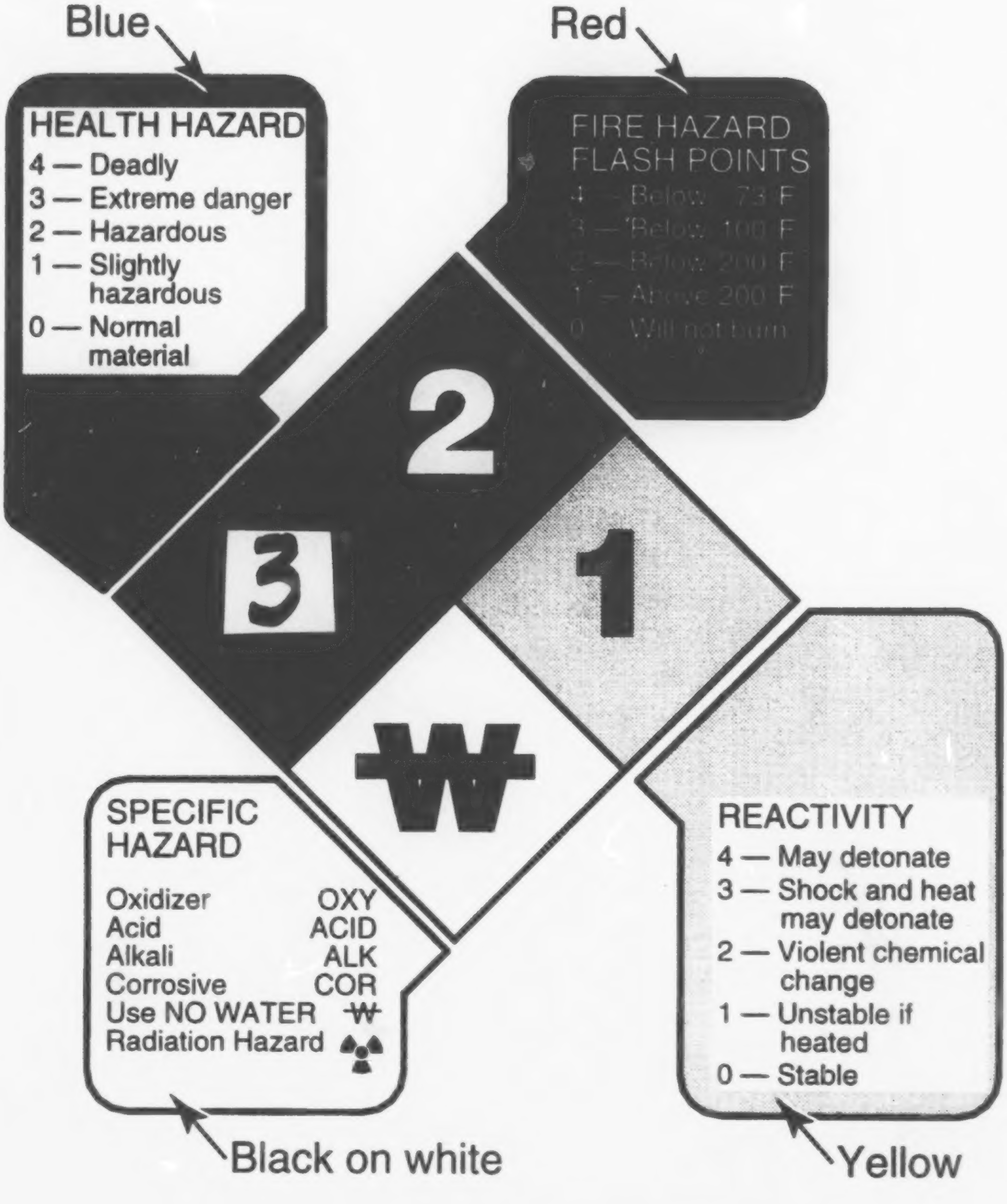


Capable of burning, exploding, or giving off harmful vapors if mixed with air, water, heat, or other materials



Capable of causing illness or death after exposure, even at very low levels

Hazardous Materials Diamond Classification System (NFPA)



Blue

HEALTH HAZARD

4 — Deadly
3 — Extreme danger
2 — Hazardous
1 — Slightly hazardous
0 — Normal material

Red

FIRE HAZARD FLASH POINTS

4 — Below 73 F
3 — Below 100 F
2 — Below 200 F
1 — Above 200 F
0 Will not burn

SPECIFIC HAZARD

Oxidizer	OXY
Acid	ACID
Alkali	ALK
Corrosive	COR
Use NO WATER	~~W~~
Radiation Hazard	☢

Black on white

REACTIVITY

4 — May detonate
3 — Shock and heat may detonate
2 — Violent chemical change
1 — Unstable if heated
0 — Stable

Yellow

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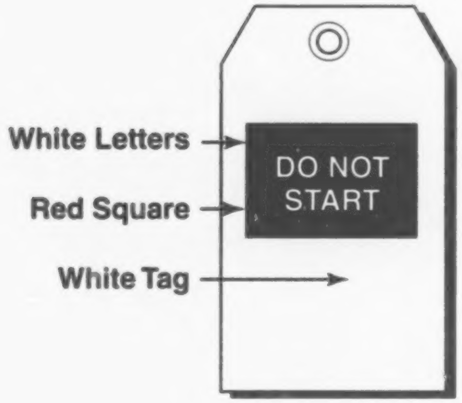
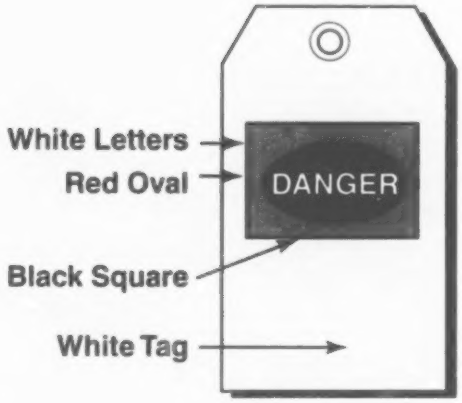
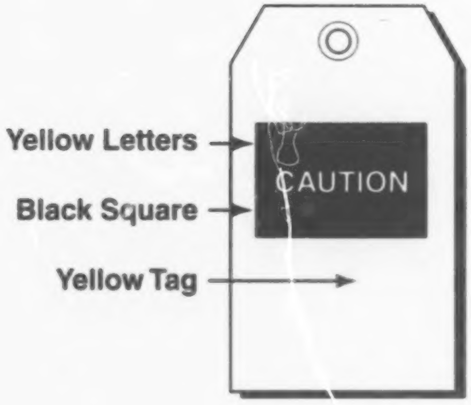
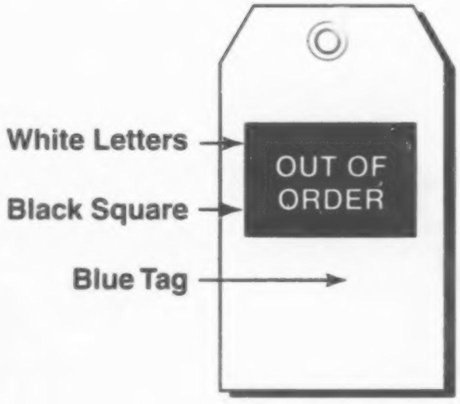
Safety Tag Color Codes


White Letters
Red Square
White Tag
DO NOT START


White Letters
Red Oval
Black Square
White Tag
DANGER


Yellow Letters
Black Square
Yellow Tag
CAUTION


White Letters
Black Square
Blue Tag
OUT OF ORDER

Unit Contents

Teacher Components

Teacher Page

Suggested Activities 3–3

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Written Test 3–9

Answers to Written Test 3–19

Learning Activities Sheet 3–23

Transparency Master

1—Mouth-to-Mouth Breathing and Cardiopulmonary Resuscitation (CPR) 3–25

Student Components

Student Page

Objective Sheet 3–3

Information Sheet 3–5

Assignment Sheet

1—Determine Basic First Aid Measures for Given Emergency Situations 3–25

Suggested Activities

Instructional Plan

Preparation

- Read the unit carefully and plan for instruction.
- Review "Teaching Suggestions." Plan for classroom activities.
- Plan your presentation to take advantage of student learning styles and to accommodate special-needs students.
- Prepare classroom. Put up posters and charts and display articles and other references related to this unit.
- Obtain films, videotapes, and other resources to supplement instruction of this unit. See "Resources Used in Developing This Unit" and "Suggested Supplemental Resources" for more information.
- For self-paced instruction, review Learning Activities Sheet. Modify as appropriate to include additional activities and/or resources available in your classroom. Make one copy for each student.
- Make a transparency from the transparency master included in this unit. This appears in the teacher edition only.

Delivery and Application

Unit Introduction (self-paced instruction)

- Provide student with Learning Activities Sheet and unit of instruction.
- Review unit contents with student.
- Have the student complete the steps in the learning activities sheet.

Unit Introduction (group instruction)

- Provide students with unit of instruction.
- Discuss unit and specific objectives.
- Discuss the information sheet. Implement teaching plan to localize, supplement, and personalize the unit. Reinforce basic academic and workplace skills when applicable.
- Discuss the assignment sheet. Review with students the criteria for evaluation of this activity.

Suggested Activities

Teaching Suggestions

- You may wish to have a certified first aid instructor teach this unit. This unit is not meant to be a first aid course, but only a review of common accidents and basic first aid information. First aid techniques (bandaging, splinting, mouth-to-mouth, etc.) should be taught by a certified instructor.

- Discuss accidents that have occurred in the diesel shop, and have students brainstorm on ways those accidents could have been prevented.

- Make sure emergency numbers are posted by the telephone for your classroom/shop area. Discuss whether or not 911 is used in your area.

- Discuss which types of injuries require emergency help (refer to Objective 6), which injuries you can transport to the hospital or doctor's office, and which injuries only need basic first aid. You may wish to have students categorize the following list into these three categories:

    - Heart attack
    - Stroke
    - Arm cut on gravel during a fall
    - Deep cut on leg (but victim is conscious)
    - Third-degree burn
    - Fainting, victim is now conscious
    - Minor (first-degree) burn
    - Broken arm
    - Asthma attack
    - Back injury, possibly broken during a fall
    - Back injury, possible strain from lifting improperly

- Chemical explosion, several victims burned

    - Electrical accident (shock)
    - Bruise
    - Eye injury from metal particles flying from grinder (not wearing safety glasses)
    - Others?

- Discuss the Good Samaritan laws in your state and how these impact on first aid practices.

- Show the first aid box (kit) available in the classroom/shop. Compare its contents with Objective 9. Discuss which items are used the most.

- Invite a member of your local emergency medical service team to speak to the class about precautions that rescuers should take to avoid contact with blood and body fluids that may be contaminated by HIV and hepatitis B.

Suggested Activities

- Have students role play how to give first aid for the various emergencies discussed in this unit (Objectives 11–14). Have students alternate between the roles of victim and rescuer. Caution students not to use actual breaths for mouth-to-mouth, breaths or chest compressions for CPR, or thrusts for Heimlich during the role playing, but they can show you when those steps would be appropriate in an actual emergency.

- Contact your local American Red Cross or local hospital for more information about CPR classes being offered. Encourage students to sign up, or you may want to have the class given at your school. Check with school officials for CPR options.

Evaluation

- Make copies of the written test. Add or modify test items as needed. The written test serves as both a pretest and posttest to assist in measuring each student's competency gains.

- Give and evaluate pretest. Modify lesson plan to include additional instruction for those areas where students were deficient.

- Evaluate the assignment sheet. Rate the student using the criteria listed on the assignment sheet. See Answers to Assignment Sheet for correct answers where applicable. If the student's performance is unacceptable, have the student review the appropriate materials and complete the assignment again.

- Give and evaluate the posttest.

- Meet individually with students to evaluate their progress through this unit of instruction and indicate to them possible areas of improvement.

- Reteach and retest as required.

Resources Used in Developing This Unit

Print Media

- *American Red Cross. Community First Aid and Safety.* St. Louis: Mosby Lifeline, 1993.

- *American Red Cross. First Aid: Responding to Emergencies.* St. Louis: Mosby Lifeline, 1991.

- Bowman, Kim. *You Can Give First Aid.* Syracuse, NY: New Readers Press, 1989.

- Goodner, Brenda. *The OSHA Handbook: Interpretive Guidelines for the Bloodborne Pathogen Standard.* El Paso, TX: Skidmore-Roth Publishing, Inc., 1993.

- *National Safety Council. First Aid and CPR.* Boston: Jones and Bartlett Publishers, Inc., 1991.
- *Safety and Health.* San Francisco: Parlay International.

Suggested Supplemental Resources

Electronic Media

- Videos

The following videos are also available as CD-ROMs. The CDs allow students to take a test with full tracking of how many questions were answered correctly or incorrectly.

— *Bloodborne Pathogens in the Workplace* (9 minutes)—Designed as an information/training video for workers who normally are not exposed to blood or body fluids, but an important part of providing precautionary information to workers. (D48007)

— *Heat Stress* (17 minutes)—This video takes a humorous approach to discussing heat stroke, heat stress, fainting, and precautions to take when working in a heat environment. (D38007)

To order the videos or CD-ROMs listed above, contact:

MAVCC
1500 West Seventh Avenue
Stillwater, OK 74074
Sales: 1-800-654-3988
www.mavcc.org
E-mail: mavcc@mavcc.com

Answers to Assignment Sheet

Assignment Sheet 1

Determine Basic First Aid Measures for Given Emergency Situations

1. Jane is probably suffering from heat stroke. Have someone call 911, and notify your supervisor. Move Jane to a cool location (outside or air-conditioned office). Cool her as quickly as possible. Remove her outer clothing and sponge bare skin with cool water or rubbing alcohol. Place cold packs at neck, armpits, head, and groin. Use fans for additional cooling.

2. Gary appears to have a third-degree burn. Have someone call 911, and notify your supervisor. Cool burned area with a damp compress (no ointment) and cover with dry, sterile dressing. Cover Gary with a blanket to prevent heat loss.

3. The customer appears to be suffering from shock as well as minor bleeding. Have someone call 911, and notify your supervisor. Treat for shock first—lay her down on her back or side if she starts vomiting. Elevate her legs, cover her to prevent heat loss, and loosen her clothing if necessary. Now treat the bleeding—Put on your disposable gloves, cover wound with dressing, and apply pressure until bleeding stops. Notify designated personnel to clean up any materials or surfaces contaminated by blood or body fluids.

4. Robert appears to be unconscious because of the electrical shock he received when electricity and water made a connection. Have someone call 911, and notify your supervisor. Turn off the electricity at the master power switch in the shop. Check Robert's breathing and pulse. Perform mouth-to-mouth breathing or CPR if necessary and if qualified. Watch for signs of traumatic shock, and treat as necessary. Check for signs of electrical burns at entrance wound and exit wound, and treat as necessary.

5. Your supervisor Susan has a severe cut and possible head injury. Have someone call 911, and notify any other supervisors in the building. Lay Susan flat. Check her breathing and pulse. Perform mouth-to-mouth breathing or CPR if necessary and if qualified. Now treat the bleeding—Put on your disposable gloves, cover wound with dressing, and apply pressure until bleeding stops. Watch for signs of shock, and treat as necessary. Notify designated personnel to clean up any materials or surfaces contaminated by blood or body fluids.

6. Ask Ted if he is choking. Administer the Heimlich maneuver by standing behind him, wrapping your arms around his middle, placing your fist on the area above his belly button, and applying quick, upward thrusts until the food is expelled. If this does not work immediately, have someone call 911 and your supervisor, but keep trying the thrusts.

Answers to Assignment Sheet

7. Lisa's minor cut needs antiseptic ointment and a bandage. Try to convince her to let you help or go get the first aid supplies so Lisa can do it herself. If she still refuses help, notify your supervisor. Emergency 911 help is not necessary in this case.

8. Todd appears to have a serious eye injury. Have someone call 911, and notify your supervisor. Have Todd close both of his eyes and apply a sterile dressing and a loose bandage. Do not let him rub his eyes.

9. Angela appears to have a closed fracture of her left arm. Have someone call 911, and notify your supervisor. Immobilize Angela's arm with splints, sling, or wraps, or wait for help and let them immobilize it. Do not move Angela.

10. Your supervisor Steve appears to be having a heart attack. Have someone call 911, and notify any other supervisors in the building. Have Steve sit or lie down, whichever is more comfortable. Loosen his clothing around his neck and midriff. Check his breathing and pulse. Perform CPR if necessary and if qualified.

Written Test

Name ____

Date ______________________________ Score __________

Objective 1

Match the terms with their definitions. Definitions continue on the next page.

1. Accident
2. Acquired immune deficiency syndrome
3. Airway obstruction
4. Anaphylactic shock
5. Antiseptic
6. Arteries
7. Bloodborne pathogen
8. Cardiopulmonary resuscitation
9. Carotid arteries
10. Choking
11. Consent
12. Coronary arteries
13. Diabetes
14. Emergency medical service
15. Epilepsy
16. First aid
17. Heimlich maneuver
18. Hepatitis
19. Injury
20. Medical emergency
21. Pressure points
22. Pulse
23. Trauma
24. Unconsciousness
25. Veins

_____ a. Immediate care given to a victim of injury or sudden illness until more advanced care can be obtained

_____ b. Technique used to restore circulation and breathing for a victim whose breathing and heart have stopped; combines chest compressions and mouth-to-mouth breathing

_____ c. Permission to provide care, given by the victim to the rescuer

_____ d. Suddenly occurring, unintentional event that causes injury or property damage

_____ e. Life-threatening bloodborne disease that depresses the immune system; caused by the human immunodeficiency virus; is eventually fatal

_____ f. Blockage of the airway by food, fluids, or other foreign objects

_____ g. Disease-causing microorganism found in infected blood and blood products

_____ h. Blood vessels that carry oxygen-rich blood from the heart to all parts of the body

_____ i. Major blood vessels that supply blood to the head and neck

_____ j. Condition in which the body does not produce enough insulin

_____ k. Severe and sometimes fatal reaction to a substance; characterized by respiratory distress, fainting, and itching

_____ l. Wound or injury caused by violence or excessive physical force

_____ m. Beat felt in arteries with each contraction of the heart

_____ n. State in which a person experiences no sensory impressions

_____ o. Procedure for forcing a foreign object from the airway of a choking victim

_____ p. Blockage of the airway that prevents air from reaching a person's lungs

_____ q. Sudden illness requiring immediate medical attention

_____ r. Trained and equipped personnel dispatched through a local emergency number to provide emergency care for ill or injured people

_____ s. Substance that blocks or slows the growth of certain microorganisms but does not kill them

_____ t. Infectious disease marked by inflammation of the liver; several types; severe cases may be fatal

_____ u. Blood vessels that supply the heart muscle with oxygen-rich blood

_____ v. Condition that occurs when the body is subjected to an external force

_____ w. Sites on the body where pressure can be applied to major arteries to slow the flow of blood to a body part

_____ x. Blood vessels that carry oxygen-poor (dark red) blood from all parts of the body back to the heart

_____ y. Chronic condition characterized by seizures that vary in type and duration; can usually be controlled by medication

Objective 2

List three examples for each of the major causes of accidents.

a. Unsafe acts

- ____
- ____
- ____

b. Unsafe personal factors

- ______________________________
- ______________________________
- ______________________________

c. Unsafe conditions

- ______________________________
- ______________________________
- ______________________________

Objective 3

State injuries that may occur in the diesel shop according to their sources of accidents.

a. Grinder— ______________________________

b. Batteries— ______________________________

c. Loose clothing— ______________________________

d. Lifting heavy objects—______________________________

e. Welding— ______________________________

f. Spills on the floor— ______________________________

Objective 4

Match basic types of accident injuries with their descriptions. Descriptions continue on the next page.

1. Amputation
2. Burn
3. Contusion
4. Dislocation
5. Electric shock, electrocution
6. Exposure to severe weather
7. Foreign body
8. Fracture
9. Internal injury
10. Open wound
11. Sprain, strain

_____ a. Broken bone; may be closed or open

_____ b. Displacement of a bone at a joint

_____ c. Loss of an arm or leg

_____ d. Twisting or wrenching of a joint or a muscle, usually with ligament damage also involved

_____ e. Damage to abdominal or pelvic body organs, usually caused by force

_____ f. Break in the skin's surface, usually with bleeding involved

_____ g. Tissue damage caused by fire or heat, chemicals, electricity, or certain radiations

_____ h. Entrance of an abnormal substance into the body

_____ i. Tissue damage caused by force; broken blood vessels under the skin cause discoloration

_____ j. Nerve and muscle damage caused by electricity traveling through the body; may cause burns and death (electrocution) if the heart is stopped by the electricity

_____ k. Various types of damage to the body caused by extremely high or low temperatures; victim may be unconscious

Objective 5

Describe in the correct order the steps for giving first aid.

a. Primary steps of first aid

- ______________________________
- ______________________________
- ______________________________
- ______________________________

b. Secondary steps of first aid

- ______________________________
- ______________________________
- ______________________________

Objective 6

List four times to call for emergency medical service.

—When victim:

a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

Objective 7

Select from the following list the information to give during an emergency phone call by placing an "X" in the appropriate blanks.

_____ a. Where victim is located

_____ b. Your occupation

_____ c. What you were doing before you found the victim

_____ d. What help (first aid) is being given

_____ e. How many are involved

_____ f. Your name

_____ g. Your home address and phone number (in case they need to contact you the next day)

_____ h. What happened

_____ i. Phone number where you are calling from

_____ j. Jokes to put everyone at ease

Objective 8

Distinguish between true and false statements concerning legal aspects of first aid by placing a "T" or "F" next to the true or false statements.

_____ a. Legally, you must always give first aid.

_____ b. Once you start first aid, you cannot stop until you can turn over the victim's care to medical workers.

_____ c. You must tell the victim who you are, how much training you have, and how you plan to help.

_____ d. Written consent must be obtained from every conscious, mentally competent adult. Oral consent is not enough.

_____ e. If a victim refuses consent, give first aid by force.

_____ f. Consent is implied for giving emergency life-saving first aid to an unconscious victim.

Written Test

Objective 9

Match the contents of a first aid box with their uses.

1. Adhesive bandages
2. Adhesive tape, roll
3. Alcohol or antiseptic wipes
4. Antiseptic skin ointment
5. Face shield or mask
6. Gauze bandage, roll
7. Gauze dressings or pads
8. Gloves, disposable
9. Scissors
10. Tweezers

_____ a. Used to act as a barrier between the victim and the first aider when blood and body fluids are present

_____ b. Used to cleanse a wound area or your hands

_____ c. Used for cleaning and covering wounds

_____ d. Used for covering small wounds

_____ e. Used to cut bandages and tape

_____ f. Used to act as a barrier between the victim and the first aider when giving mouth-to-mouth breathing

_____ g. Used to remove splinters or insect stingers

_____ h. Used for wrapping around a wound or for holding a larger dressing on the wound area

_____ i. Used for securing the dressing or bandage

_____ j. Used to prevent infection, especially for minor cuts

Objective 10

Complete statements concerning bloodborne pathogens and special first aid precautions by circling the correct answers.

a. In any situation involving blood or body fluids, there is a **(small) (large)** risk of infection from very serious bloodborne pathogens.

b. Bloodborne pathogens include HIV and hepatitis **(A) (B)**.

c. Treat all victims as if they **(were) (were not)** infected because you cannot tell by looking at someone if they are infected with bloodborne pathogens.

d. Always wear **(leather) (latex)** gloves as a barrier.

e. Use face masks with a one-way valve for protection when performing **(the Heimlich maneuver) (mouth-to-mouth breathing)**.

f. **(Do) (Do not)** eat, drink, or touch your mouth, nose, or eyes when giving first aid.

g. When cleaning up, vigorously wash your skin in **(hot, soapy water) (diluted bleach)**, and rinse well.

Objective 11

Complete statements concerning basic first aid procedures for various emergencies by circling the correct answers.

a. For a severely bleeding cut on the left leg that will not stop, apply pressure to the left **(brachial) (femoral)** artery.

b. For open fractures, **(do) (do not)** try to push the bone back into place.

c. If a spinal injury is suspected, **(do) (do not)** move the victim.

d. For second-degree burns, **(do) (do not)** break all visible blisters.

e. **(Do) (Do not)** apply medicated ointment to third-degree burns.

f. Check **(poison control center) (MSDS)** for more first aid instructions on how to treat chemical burns.

g. **(Do) (Do not)** restrain anyone having convulsions and **(do) (do not)** try to place a pencil or wooden spoon between their teeth.

h. The first thing to do when an electrical accident happens is to **(shut off the electrical current) (perform CPR)**.

i. For eye injures, **(do) (do not)** allow the victim to rub his/her eyes.

j. A victim complaining of chest pain, nausea, and difficult breathing may be having a **(stroke) (heart attack)**.

k. A man working outside in the middle of a hot summer day faints. He has no perspiration and hot, red skin. His condition is called heat **(exhaustion) (stroke)**.

l. Victims of shock usually have **(very cold) (very hot)** skin.

Objective 12

Arrange in order the steps on how to treat choking by placing the correct sequence numbers (1–7) in the appropriate blanks.

_____ a. Make a fist of the other hand, and put the thumb side of the fist just above your finger on the belly button (and below the ribs).

_____ b. Repeat the thrusts until they work or until trained help comes.

_____ c. Wrap your arms around the victim's waist, and place your finger on their belly button.

_____ d. If the victim cannot speak, stand directly behind him/her.

_____ e. Take your finger off their belly button, and place this hand over your fist.

_____ f. Ask the victim, "Are you choking?"

_____ g. Give quick, upward thrusts into the abdomen. This forces air trapped in the lungs to push the object out of the airway.

Written Test

Objective 13

Distinguish between true and false guidelines for giving mouth-to-mouth breathing by placing a "T" or "F" next to the true or false statements.

_____ a. Check to see if victim is conscious or unconscious by patting his/her face and shouting out loud, "Snap out of it!"

_____ b. The victim must be lying on his/her side so you can give them mouth-to-mouth breathing.

_____ c. Tilt the victim's head back and lift his/her chin up to open the airway more.

_____ d. Check victim's breathing for one minute.

_____ e. If victim is breathing, begin CPR if trained.

_____ f. If victim has no pulse and is not breathing, begin CPR if trained.

_____ g. To give mouth-to-mouth breathing, pinch the victim's nose shut, put your mouth tightly over the victim's mouth, and gently give two breaths into the victim's mouth, each lasting about 1 $^{1}/_{2}$ seconds.

_____ h. If the person has a pulse but is not breathing, perform CPR if trained.

_____ i. If the person has no pulse and is not breathing, perform CPR if trained.

_____ j. Continue to give breaths with four-second waits between breaths until the victim starts to breathe or until trained help comes.

Objective 14

Complete statements on the basic steps for performing cardiopulmonary resuscitation by circling the correct answers.

a. If victim has a pulse but is not breathing, give **(mouth-to-mouth breathing) (CPR)**.

b. If the person has no pulse and is not breathing, give **(mouth-to-mouth breathing) (CPR)**.

c. The correct location to position your hands on the victim's chest is the **(lower) (upper)** end of the breast bone.

d. Position yourself **(kneeling) (sitting)** next to the victim with your shoulders directly over your hands, with your elbows locked.

e. Compress the chest by pressing down **(1 $^{1}/_{2}$–2″) (3– 4″)**, then release.

f. Push with the weight of your **(arms) (upper body)**.

g. Keep a steady down-and-up rhythm, and **(do) (don't)** pause between compressions.

h. Give **(5) (10) (15)** compressions, then give 2 slow breaths.

i. This cycle of compressions and breaths takes about **(15) (30)** seconds total.

j. Give **(4) (10)** continuous cycles of CPR, and then check pulse.

***Permission to duplicate this test is granted.**

Answers to Written Test

Objective 1

a. 16
b. 8
c. 11
d. 1
e. 2
f. 10
g. 7
h. 6
i. 9
j. 13
k. 4
l. 23
m. 22
n. 24
o. 17
p. 3
q. 20
r. 14
s. 5
t. 18
u. 12
v. 19
w. 21
x. 25
y. 15

Objective 2

a. Unsafe acts—Any three of the following:

- Cleaning, oiling, adjusting, or repairing of moving, energized, or pressurized equipment
- Failure to receive proper instruction
- Failure to use personal protective equipment
- Failure to secure area or warn others of danger
- Horseplay, quarreling, or fighting
- Ignoring instructions or operating without permission or authority
- Improper use of equipment
- Improper use of hands or body parts
- Inattention to footing or surroundings
- Operating or working at unsafe speed
- Removing safety devices
- Using unsafe equipment

b. Unsafe personal factors—Any three of the following:

- Being under the influence of alcohol/drugs
- Fatigue
- Illness
- Improper attitude
- Lack of job knowledge or skill

c. Unsafe conditions—Any three of the following:

- Defective tools, equipment, substances
- Dress or apparel hazard
- Environmental hazards such as temperature extremes or contaminated air
- Hazardous methods or procedures
- Inadequately guarded machines or area
- Improper illumination
- Improper storage of hazardous and flammable materials
- Poor housekeeping

Answers to Written Test

Objective 3

a. Grinder—May cause eye or face injury from flying sparks or metal chips
b. Batteries—May explode when near open flame or electrical spark
c. Loose clothing—May catch in rotating parts
d. Lifting heavy objects—May cause severe back injury
e. Welding—May cause injury to eyes and to skin if protective equipment is not worn
f. Spills on the floor—May cause falls

Objective 4

a. 8
b. 4
c. 1
d. 11
e. 9
f. 10
g. 2
h. 7
i. 3
j. 5
k. 6

Objective 5

a. Primary steps of first aid

- Make sure the victim is in a safe place.
- Check the victim's breathing.
- Check the victim's circulation.
- Stop any severe bleeding.

b. Secondary steps of first aid (any three of the following:)

- Call for emergency medical help or have someone else make the call.
- Always have a reason for what you do.
- Stay calm. Talk to the victim.
- Ask the victim what happened and where he/she is hurt.
- Check for a medical alert bracelet, necklace, or wallet card.
- Take care of other injuries.

Objective 6

Any four of the following:

a. Is unconscious, unusually confused, or seems to be losing consciousness
b. Has trouble breathing, is breathing in a strange way, or is not breathing
c. Has persistent chest pain or pressure
d. Has pressure or pain in the abdomen that does not go away
e. Is vomiting or passing blood
f. Has seizures, severe headache, or slurred speech
g. Appears to have been poisoned
h. Has injuries to the head, neck, or back

Objective 7

a, d, e, f, h, i

Objective 8

a. F
b. T
c. T
d. F
e. F
f. T

Answers to Written Test

Objective 9

a. 8
b. 3
c. 7
d. 1
e. 9
f. 5
g. 10
h. 6
i. 2
j. 4

Objective 10

a. Small
b. B
c. Were
d. Latex
e. Mouth-to-mouth breathing
f. Do not
g. Hot, soapy water

Objective 11

a. Femoral
b. Do not
c. Do not
d. Do not
e. Do not
f MSDS
g. Do not, do not
h. Shut off the electrical current
i. Do not
j. Heart attack
k. Stroke
l. Very cold

Objective 12

a. 4
b. 7
c. 3
d. 2
e. 5
f. 1
g. 6

Objective 13

a. F
b. F
c. T
d. F
e. F
f. T
g. T
h. F
i. T
j. T

Objective 14

a. Mouth-to-mouth breathing
b. CPR
c. Lower
d. Kneeling
e. $1\frac{1}{2}$–2″
f. Upper body
g. Don't
h. 15
i 15
j. 4

Prerequisites:
None

Learning Activities Sheet

Student Name ________________________________

Place a checkmark in the appropriate box as you complete each of the steps below.

☐ 1. **Take** Pretest provided by instructor. After test has been evaluated, follow instructor's recommendations.

☐ 2. **Read** Objective Sheet.

☐ 3. **Study** Information Sheet, Objectives 1 through 10.

Optional

☐ 4. **View** Videotape entitled *Bloodborne Pathogens in the Workplace.*

☐ 5. **Study** Information Sheet, Objective 11 through 14.

Optional

☐ 6. **View** Videotape entitled *Heat Stress.*

☐ 7. **Research** Online resources regarding first aid. Visit http://www.mayohealth.org/mayo/firstaid/htm/ as one of your sources.

☐ 8. **Do** Assignment Sheet 1, "Determine Basic First Aid Measures for Given Emergency Situations."

☐ 9. **Stop** Have instructor evaluate the completed assignment sheet and if the evaluation is satisfactory, continue to step 10. If the evaluation is not satisfactory, repeat steps 5, 8, and 9.

☐ 10. **Check** With instructor for any additional assignments to be completed.

☐ 11. **Do** Additional assignments listed below.

____

____

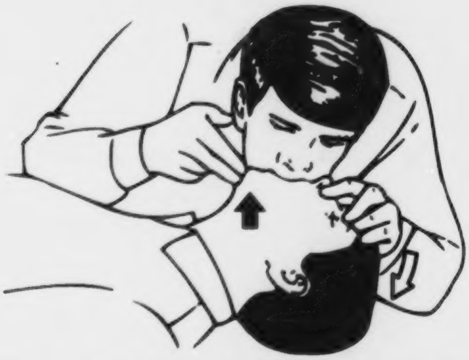
____

☐ 12. **Take** Posttest provided by instructor. After test has been evaluated, follow instructor's recommendations.

☐ 13. **Stop** Have instructor evaluate your unit performance. If the evaluation is satisfactory, proceed to next learning activities sheet. If evaluation is not satisfactory, ask instructor for further instructions.

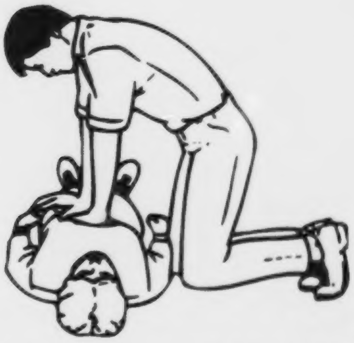
***Permission to duplicate this form is granted.**

Mouth-to-Mouth Breathing and Cardiopulmonary Resuscitation (CPR)



Courtesy of the American Red Cross. All Rights Reserved in All Countries.

If person is not breathing, give mouth-to-mouth breathing if trained.



Courtesy of the American Red Cross. All Rights Reserved in All Countries.

If person is not breathing and has no pulse, give CPR if trained. CPR consists of cycles of chest compressions and mouth-to-mouth breathing.

Diesel Technology

Safety Skills

Second Edition

MAVCC

Student Edition

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Diesel Technology: Safety Skills

Second Edition

Student Edition

Written by

Mary Kellum

Developed by

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Objective Sheet

Unit Objective

After completing this unit, the student should be able to discuss general safety rules and apply them to the school and the workplace, determine the correct fire extinguishers to use for various situations, operate a fire extinguisher, and lift a heavy object properly. The student should demonstrate these competencies by completing the assignment sheets and job sheets and by scoring a minimum of 100 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to general safety with their definitions.
2. Discuss ways of developing a good safety attitude.
3. List expectations for a safe environment at school or work.
4. List basic types of emergencies.
5. Discuss severe weather guidelines.
6. Arrange in order the steps to follow in case of a bomb threat.
7. Describe how to conduct a fire evacuation.
8. List the types of personal protective equipment.
9. Distinguish between incorrect and correct personal safety guidelines.
10. Complete statements concerning guidelines for maintaining a safe work area.
11. Match causes of back injuries with their contributing factors.
12. Complete guidelines for lifting and moving items safely.
13. List components of a fire.
14. Match the classifications of fires with their correct fuel sources.
15. Match the types of fire extinguishers with the classes of fires they are designed to extinguish.
16. Match fire extinguisher symbols with their meanings.
17. Arrange in order the steps in using a fire extinguisher.
18. Discuss ways to prevent fires.
19. Subscribe to a safety pledge. (Assignment Sheet 1)

20. Apply general safety principles to the school and workplace. (Assignment Sheet 2)

21. Determine correct fire extinguishers to use for various situations. (Assignment Sheet 3)

22. Lift a heavy object properly. (Job Sheet 1)

23. Operate a fire extinguisher. (Job Sheet 2)

Information Sheet

Objective 1

Terms and definitions

a. **Accident**—Any suddenly occurring, unintentional event that causes injury or property damage

b. **Carelessness**—Failure to think before one acts; failure to pay attention

c. **Drill**—Exercise practiced so that all members can demonstrate what to do in case of an emergency

d. **Emergency**—Any accident or sudden illness that requires immediate intervention to prevent severe damage or death

e. **Evacuation**—Moving people out of a disaster or dangerous area into a safe place

f. **Extinguish**—To put out a fire; to cause to cease burning

g. **Hazard**—Source of danger

h. **Personal protective equipment** (PPE)—Devices used or worn to protect the physical health of an equipment operator or tool user

i. **Safety**—Freedom from danger, risk, or injury

Objective 2

Developing a good safety attitude

Note: Developing a positive attitude toward safety can save your money, your job, and even your life! Don't think "it can't happen to me" because it does every day.

a. **Focus on the present task**. Stay alert. If you're tired or bored, accidents can happen.

b. **Take time to do the job right.** Staying safe may take a little extra time, but it will result in fewer mistakes. Determine what needs to be done first so you won't run out of time on high priority tasks.

c. **Use your head.** Do what you know is right. Don't take shortcuts or fool around. Also don't let emotions like anger or frustration get in the way of doing a good job.

d. **Take responsibility for your actions.** Others trust and depend on you to do your job correctly. If you do not act responsibly, others may suffer. Understand that safety is everyone's responsibility.

e. **Avoid unnecessary risks.** Think of what could happen if you take a chance on an unsafe task. Many risks are dangerous and are not worth it.

Information Sheet

Objective 3

Expectations for a safe environment at school or work

a. Lighting is adequate to perform required duties and to prevent eyestrain.

b. Air is clean, without harmful fumes.

c. Alarms are located to notify everyone in case of emergencies.

d. Emergency exits are clearly marked, unlocked, and accessible.

e. Emergency telephone numbers are posted.

Examples: Fire and police departments, ambulance service, poison-control center

f. Fire extinguishers are readily available.

g. First aid supplies are available.

h. Walkways are clear, barrier-free, and accessible to all.

i. Safety rules are posted.

j. Evacuation routes are posted.

k. All students/employees receive safety training.

l. Personal protective equipment is available for all.

m. No smoking/smoking areas are designated.

n. Adequate storage areas are provided for hazardous materials.

o. Hazardous materials are clearly identified.

Objective 4

Basic types of emergencies

Note: Knowing what to do and then acting quickly may lessen the damage or injury involved in the following emergencies.

a. Severe weather and natural disasters—Tornados, hurricanes, earthquakes, floods, etc.

b. Bombs and bomb threats

c. Fires

d. Accidents—Falls, cuts, burns, electrical shocks, poisonings, etc.

e. Health problems—Heart attacks, strokes, seizures, heat exhaustion, etc.

Note: Accidents and health emergencies should be handled by trained personnel. Your job may be to call for help or to administer basic first aid. More information on first aid will be given in Unit 3.

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Objective 5

Severe weather guidelines

a. When alarms (sirens) or warnings are issued by the local civil defense or national weather center, begin procedure to take cover.

b. Move quickly and quietly to shelter area on the lowest level and in the interior of the building away from glass and outside openings.

c. Sit down and protect yourself by putting your head as close to your lap as possible, or kneel down and cover your face and head with your arms.

d. Answer to roll call if at school.

e. Remain in designated area until the signal is given to return.

Objective 6

Steps to follow in case of a bomb threat or threatening telephone call

a. When you answer the call, obtain as much information as possible from and about the caller. Record the call if possible.

Examples: Male, female, background noises, accent, voice characteristics

b. Alert your instructor, supervisor, or building administrator immediately.

c. Begin building evacuation immediately.

d. A building search will be conducted by police/bomb squad.

e. An "All Clear" signal will be given when it is safe to return to the building.

Objective 7

Fire evacuation guidelines

a. Upon discovery of a large fire or smoke or activation of a smoke detector, you should:

- Pull the nearest fire alarm.
- Close the doors around the fire to contain it.
- Notify the building administrator or telephone operator (0 or 911) of the fire and its exact location.

b. Evacuate building as soon as alarm sounds in the following manner:

- Remain calm and move quickly to exits. Do not use the elevators.
- Close windows and doors as you leave your area. This limits the amount of oxygen the fire receives and prevents the spread of smoke.
- Feel closed doors before opening them. Doors that are hot indicate a fire on the other side.

- If you are unable to exit through the door and you must wait for rescue through windows, place wet cloths on the floor next to the door to prevent the spread of smoke into the room. A wet towel over the head will help if you must walk through smoke to an exit. DO NOT ENTER THICK SMOKE.
- Once at the designated area, remain calm and stay with your group. All persons must be accounted for.

Objective 8 **Types of personal protective equipment**

Note: This includes the personal protective equipment required by *OSHA 29 CFR 1910. 132-140.*

a. **Eye protection**

- Goggles
- Safety glasses with side panels
- Face shield (to be used with safety glasses or goggles as additional face protection)
- Welding helmet with filter lenses

b. **Hearing protection**

- Ear plugs—Positioned in the outer part of the ear and may reduce noise by as much as 30 decibels
- Ear muffs—Cover the entire ear and can reduce noise by as much as 15–30 decibels

  Note: Muffs may be used with ear plugs when a worker is exposed to extremely high noise levels—105 decibels and above.

c. **Head protection**

- Full-brimmed hard hat—Protects against blows to the entire head, neck, and shoulders
- Visored hard hat (front-brim only)—Used when working in confined spaces
- Bump caps—Used in confined spaces where there are no serious head hazards
- Hair covers—Prevent hair from becoming caught in moving machine parts

d. **Foot protection**

- Safety shoes, steel reinforced toe box and insole—Protect feet from falling or rolling objects, cuts, and puncture injuries
- Safety boots—Offer more protection when splash or spark hazards (chemicals, molten materials) are present

e. **Hand protection**—Work gloves

- Disposable gloves—For handling mild irritants
- Fabric gloves—For better grip on slippery objects
- Rubber gloves—For use around chemicals and other corrosives
- Leather gloves—For working with rough surfaces

f. **Respiratory protection**

- Filtration respirators—Filter or "screen" out contaminants from the air you breathe
- Purifying respirators—Contain replaceable chemical cartridges or canisters that "purify" or entrap contaminants
- Air-supplying (also called supplied-air) respirators—Provide clean air from an outside source

Objective 9

Personal safety guidelines

a. Wear personal protective equipment as required.

Examples: Eye protection when using electric tools such as drills; respirator when painting; rubber gloves when using parts-cleaning solution; ear protection when running engines

b. Comply with all safety rules and posted signs.

c. Follow instructions when performing a task. Ask your teacher or employer questions if you do not understand.

d. Never operate, adjust, or repair equipment without permission and proper training.

e. Report defective tools and equipment immediately.

f. Report all accidents and get first aid immediately.

g. Correct or report all unsafe conditions immediately.

h. Keep mentally alert to shop hazards.

i. Conduct yourself in a manner conducive to safe shop practices.

j. Never "horse around" on the job. Don't play around with equipment in class or at work. Don't play jokes on others to distract them when they are working.

Objective 10

Guidelines for maintaining a safe work area

a. Arrange equipment and vehicles to allow safe working practices and ease of cleaning.

b. Store materials and supplies safely in their proper places.

c. Store tools and accessories safely in suitable storage containers or areas.

d. Keep work area organized and clear of debris and other hazards.

e. Keep floors clear of obstacles and slippery substances.

f. Clean up spills immediately. Use a commercial oil absorbent to remove oily spills.

g. Keep aisles, exits, and traffic areas free of materials and debris.

h. Keep electrical cords and extension cords out of traffic areas.

i. Store oily, greasy, and paint-soaked rags in approved metal containers.

j. Know where first aid and fire fighting equipment are kept so they are immediately available in case of an emergency.

Objective 11

Contributing factors and causes of back injuries

a. **Weight**—Injury usually results from overestimating your physical abilities and trying to lift more weight than you can handle.

b. **Size**—Injury usually results from moving an object that may be within your weight capacity, but is too long, high, or wide to lift safely.

c. **Shape**—Injury usually results from moving an object that may be within your weight capacity, but has a cylindrical shape or other odd shape that makes safe lifting difficult.

d. **Obstructions**—Injury usually results from stacking materials so high that vision is limited and obstructions in the pathway cannot be seen.

e. **Improper position**—Injury usually results from twisting or turning to an awkward position when lifting.

f. **Improper storage**—Injury usually results in strain caused by not storing heavy objects at least 12 inches off the floor.

g. **Improper reaching**—Injury usually results from using chairs or boxes to stand on instead of safely using a ladder, or by positioning object too far from work.

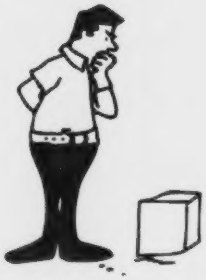
Objective 12

Guidelines for manual lifting and moving

a. Before lifting

- Inspect the item to be lifted for jagged edges, splinters, and grease or other slippery surfaces.

Figure 1



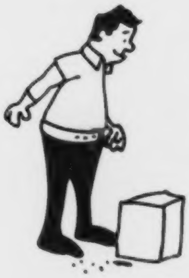
- Wear gloves for protection, and make sure that they fit properly.
- Plan your route before you lift.
- Clear any obstacles from your path.
- Assess the weight of the load.
- Get help to lift heavy loads.

Note: Teamwork works best when both persons are about the same size. The load should be distributed evenly between both workers.

b. Lifting

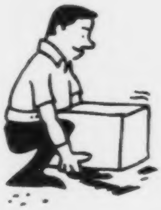
- Place your feet as close to the load as possible and 8 to 12 inches apart for good balance.

Figure 2



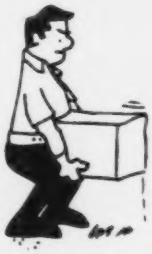
- Bend your knees, keeping your back and neck straight and your chin tucked in.
- Grasp the load firmly with your fingers and hands.
- Draw your arms in close to your body.

Figure 3



- Stand slowly and lift smoothly, using your *legs*.

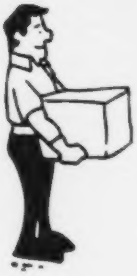
Figure 4



c. **Carrying**

- Hold the item close to your body in a comfortable carrying position.

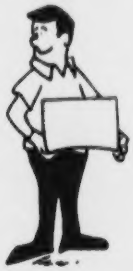
Figure 5



- Do not allow the load to block your vision.

- Do not twist your body to change direction. Turn with your feet and move your whole body.

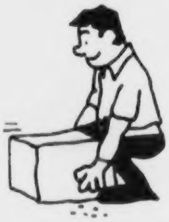
Figure 6



d. **Setting the load down**

- Bend your knees.
- Keep your back and neck straight and aligned.
- Place the load carefully on the floor or shelf, taking care not to set it on your fingers or feet.
- Be sure the load is secure.

Figure 7

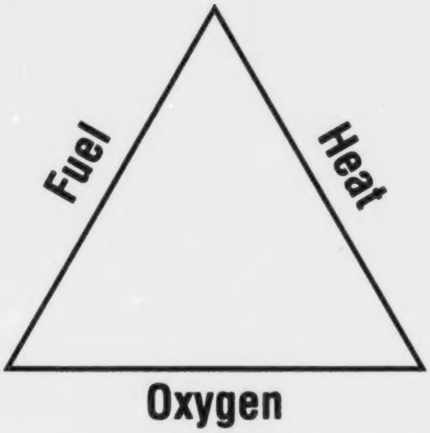


Objective 13

Components of fire

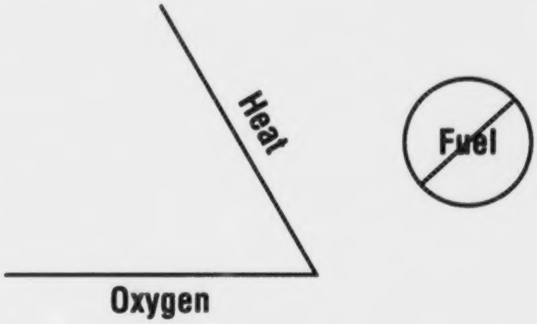
Note: If any one of the three components of fire is missing, a fire cannot be started or, with the removal of any one of them, the fire will be extinguished.

Figure 8


Fuel
Heat
Oxygen

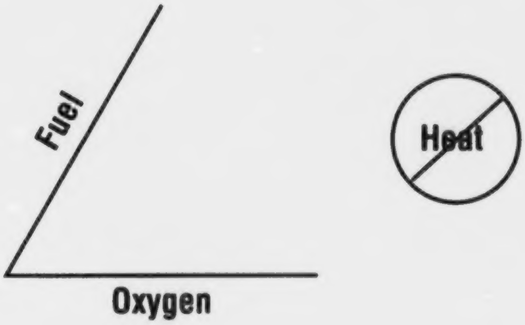
a. Fuel—Any combustible material

Figure 9


Heat
Oxygen
Fuel

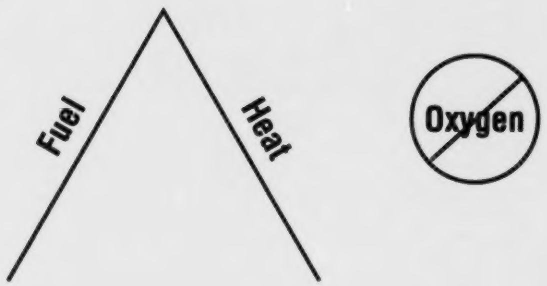
b. Heat—Enough to raise the fuel to its ignition temperature

Figure 10


Fuel
Oxygen
Heat

c. Oxygen—Necessary to sustain combustion

Figure 11



Objective 14

Classifications of fires (by their fuel sources)

a. **Class A**—Fires that occur with ordinary combustible materials

Examples: Wood, paper, trash, rags

b. **Class B**—Fires that occur with flammable liquids

Examples: Gasoline, oil, grease, paints, diesel fuel

c. **Class C**—Fires that occur in or near electrical equipment

Examples: Wiring, electrical appliances, motors

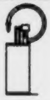
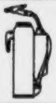
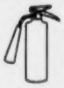
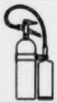
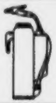
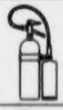
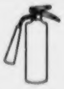
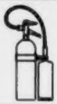
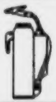
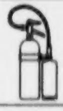
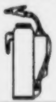
d. **Class D**—Fires from combustible metals

Examples: Magnesium; sodium, potassium, and sodium-potassium alloys

Note: These types of fires are more common in industrial settings. They require a special dry powder, Class D extinguisher.

Objective 15

Types of fire extinguishers and classes of fires they are designed to extinguish

Type of Fire	Approved Type of Extinguisher				
	Pressurized Water	**Carbon Dioxide**	**Multi-Purpose Dry Chemical**	**Halon Gas**	**Foam**
Class A Fires ORDINARY COMBUSTIBLES • Wood • Paper • Cloth, etc.					
Class B Fires FLAMMABLE LIQUIDS, GREASE • Gasoline • Paints • Oils, etc.					
Class C Fires ELECTRICAL EQUIPMENT • Motors • Switches, etc.					
Class D Fires COMBUSTIBLE METALS • Magnesium • Phosphorus • Iron					

a. **Foam**—Spray foam above fire, allowing foam to fall lightly on the fire; use for class A or class B fires.

> **Caution**: Do not spray a stream directly into the fire.

b. **Carbon dioxide (CO_2)**—Direct discharge as close to fire as possible, first at the edge of flames, then gradually forward and upward; use for class B or class C fires.

c. **Pressurized water**—Direct stream at base of fire; use for class A fires only.

d. **Dry chemical**—Direct at the base of the flames, then follow up by directing at remaining materials that are burning; use for all classes of fires.

e. **Halon**—Stand back several feet, hold container upright and direct at the base of fire, sweeping from side to side; use for class B or class C fires.

Note: Halon is a clean, pressurized, liquefied gas which does not leave a residue.

> **Caution**: A high concentration of burned halon gas may be hazardous to your health.

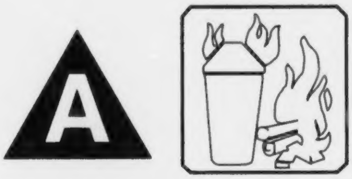
Objective 16

Fire extinguisher symbols and their meanings

Note: All portable fire extinguishers are labeled with picture and shape symbols. Each of the shape symbols contains the letter of the fire class for which the extinguisher is effective. Because speed is important when a fire is discovered, you should be able to glance at the symbols and know immediately whether the extinguisher is appropriate for the fire on hand.

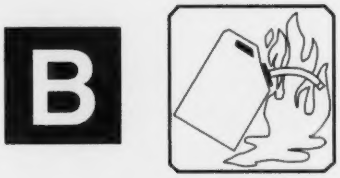
a. Class A—Green triangle

Figure 12



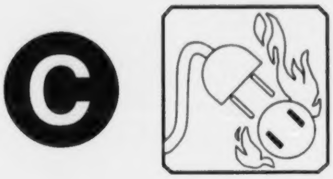
b. Class B—Red square

Figure 13



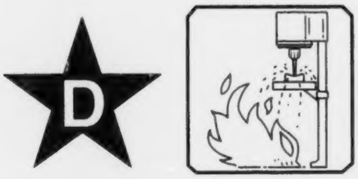
c. Class C—Blue circle

Figure 14



d. Class D—Yellow star

Figure 15



Objective 17

Steps in using a fire extinguisher

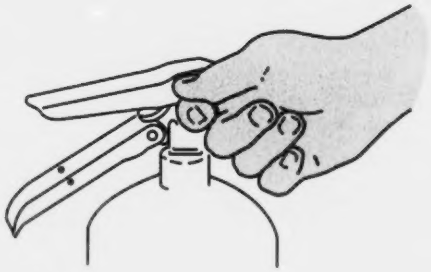
Note: Most small fires can be put out before they become large fires if you use the correct extinguisher and act quickly. However, if you have any doubts about being able to control it, evacuate and get help instead of trying to extinguish it yourself.

a. **Identify** the class of fire (A–D) and then make sure your fire extinguisher is coded to put out that type of fire. Check the label on the fire extinguisher.

Note: The most common type of fire extinguisher is the multi-purpose A-B-C extinguisher which can be used on those three classes of fires. Some extinguishers will only put out one class of fire. Check to make sure.

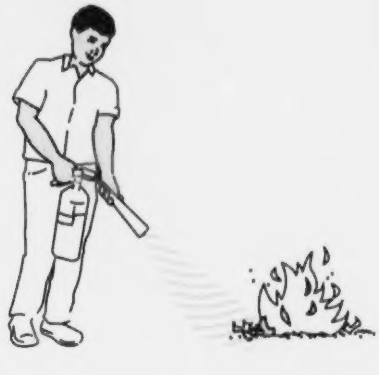
b. **Pull** the pin. Some extinguishers require releasing a lock latch, pressing a puncture lever, or other step.

Figure 16



c. **Aim** the extinguisher nozzle (or its horn or hose) at the base of the fire.

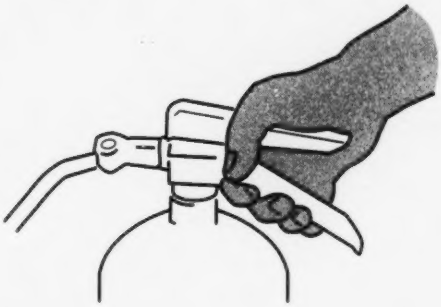
Figure 17



d. **Squeeze** the handle. This releases the extinguishing agent (carbon dioxide or other chemical).

> **Caution:** Do not touch the nozzle of the fire extinguisher. The CO_2 released is 130 degrees below zero which will burn the skin.

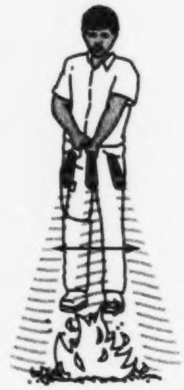
Figure 18



e. **Sweep** from side to side until the fire appears to be out. Watch the fire area. If fire breaks out again, repeat the process.

Note: One way to remember this sequence is the first letters of the steps spell "I PASS." Most portable extinguishers work according to these directions. Follow the directions printed on the model you are using.

Figure 19



Objective 18

Ways to prevent fires

a. Keep equipment clean and in good operating condition.

b. Never overload electrical circuits.

c. Store flammable/combustible materials in appropriate containers away from heat sources.

d. Keep work and trash areas clean and free of debris.

e. Dispose of flammables according to established safety guidelines.

f. Never leave open flames unattended.

g. Use caution when operating spark-producing equipment.

h. Clean up spills (if appropriate) or report.

i. Report suspicious persons (possible arsonists) to security or supervisory personnel.

j. Keep fire exits/escape routes clear and well-marked.

k. Know where fire alarm boxes are located.

l. Know where fire extinguishers are located.

m. Always be on the lookout for fires or conditions that could cause a fire and report them immediately.

n. Properly dispose of cigarettes and matches.

o. Always obey "no smoking" signs and areas.

Objective 19

Assignment Sheet 1—Subscribe to a Safety Pledge

Name ______________________ Overall Rating __________

Date ______________________

Evaluation Criterion	Rating
• Form is properly signed and dated	______

Basic Skills

Reading

Employability

Directions

Read the following safety rules, and if you agree to follow them, sign the pledge and date it. Your parent's signature is also required if you are under their supervision.

SAFETY PLEDGE

______________________________________, who is a student enrolled in diesel technology, will be in contact with power equipment, hazardous materials, and some physical dangers involving engines.

This student will receive instruction about safety and correct procedures to follow to protect him/her from danger.

The student must assume the responsibility for safe practices, and we therefore ask that she/he subscribe to the following safety pledge:

1. **I will follow all safety rules.**
2. **I will never use a machine without first having permission from my instructor or supervisor.**
3. **I will not ask permission to use a particular machine unless I have been instructed in its use and have scored 100 percent on the safety test for that machine.**
4. **I will report immediately any accident or injury, no matter how minor, to my instructor or supervisor.**

Student's Signature ______________________ Date __________

I hereby give consent to allow my daughter/son to operate all equipment necessary in carrying out the requirements of the course.

Parent's (Guardian's) Signature ________________ Date __________

Objective 20

Assignment Sheet 2—Apply General Safety Principles to the School and Workplace

Name ______________________ Overall Rating ________

Date ______________________

Evaluation Criteria	Rating
• Answers are appropriate	______
• Descriptions are complete with correct grammar, spelling, and punctuation	______

Basic Skills

Reading Writing Critical Thinking Employability

Directions

Answer the following questions concerning safety in your school and at the work site. Be as specific as possible. Refer to your school handbook or information from your instructor and the "Policies and Procedures Manual" for your work facility.

1. Personal Protective Equipment
   a. What personal protective equipment are you required to wear at school? ______________________

   ____

   b. What at work? ______________________

   ____

   c. Under what situations will the requirements vary? __________

   ____

2. Safety Procedures to Follow
   a. What should you do if you see an accident happen at school?

   ____

   ____

b. Accident at work? ____________________

____

____

c. What should you do if you are the first to discover a small fire at school? ____________________

____

____

d. Small fire at work? ____________________

____

____

e. What should you do if you are the first to discover a large fire at school? ____________________

____

____

f. Large fire at work? ____________________

____

____

g. What should you do if you answer the telephone at school and it is a bomb threat? ____________________

____

____

h. Bomb threat at work? ____________________

____

____

i. What should you do if you hear the severe weather alert (civil defense sirens or alarms) while you are at school? ____________________

____

____

j. Severe weather alert at work? ______________________________

____

____

3. Safety Attitude

a. What can you lose if you don't follow the safety rules and established procedures at school and work? ______________

____

____

b. Select an accident that you have had, or one that you have seen, and describe what could have been done to prevent it.

____

____

____

____

____

c. How would you feel if you lost your eyesight in an accident that could have been prevented? How would that accident change your life? ______________________________

____

____

____

Objective 21

Assignment Sheet 3—Determine Correct Fire Extinguishers to Use for Various Situations

Name ______________________ Overall Rating ________

Date ______________________

Evaluation Criteria	Rating
• Directions are followed	______
• Answers are correct	______

Basic Skills

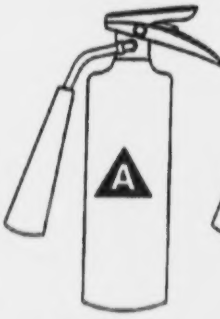
Reading Critical Thinking Employability

Introduction

There are many fire hazards in the diesel technology shop. These include engines, electrical circuits, power tools, welding torches, batteries, and flammable solvents, oils, and fuels. For this reason, it is very important for you to be able to correctly respond to a fire.

Directions

Read each of the situations given and choose the correct fire extinguisher(s) that could be used. More than one answer is possible.



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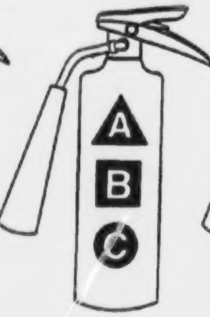

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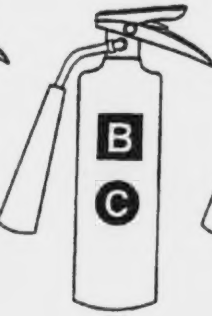

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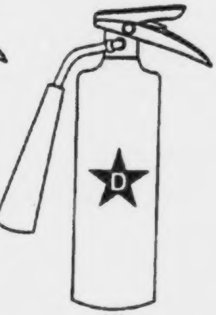

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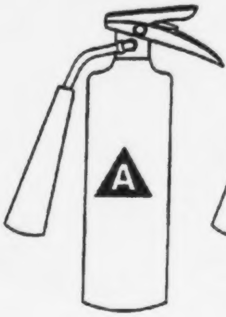
_____ a. Fire in a filing cabinet containing old invoices

_____ b. Smoke coming from the electric motor of an air compressor

_____ c. Fire caused by cigarette ashes dropping into a vat of solvent

_____ d. Smoke coming from a barrel of oily rags

Assignment Sheet 3



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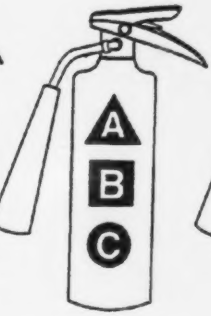

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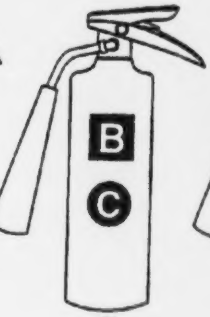

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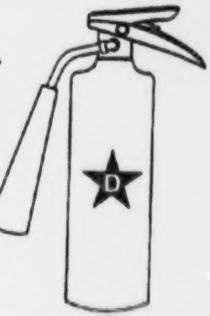

(4)

_____ e. An electric hot plate left unattended in an office ignites papers on a bulletin board and spreads to wood paneling

_____ f. Fire in an engine compartment that started because someone poured gasoline into a carburetor

_____ g. Smoldering seat upholstery ignited by a cigar

_____ h. Smoke coming from a battery charger

_____ i. Puddle of spilled gasoline ignited by flames from a gas water heater

_____ j. Smoke coming from a dash instrument panel

Objective 22

Job Sheet 1—Lift a Heavy Object Properly

Name ______________________ Attempt Number ______

Date ______________________ Overall Rating ______

Evaluation Criteria	Rating
• Load was safely lifted	______
• Load was safely carried and set down	______

Basic Skills

Reading Employability

Introduction

The number one worker injury in America today is back strain or injury. Most of these injuries come from trying to lift an object that is too heavy or from lifting an object improperly. It is very important, therefore, that you learn to assess the weight of a load to be lifted, and either get help to lift the load or lift the load properly, using your leg muscles, not your back.

Instructions

When you are ready to perform this task, ask your instructor to observe the procedure and rate your performance using the evaluation criteria.

Tools, equipment, and materials

- Large, heavy box
- Gloves
- Lower-back support belt (optional)

Procedure

☐ 1. Put on gloves (and optional lower-back support belt if required by instructor).

☐ 2. Size up the load.

☐ 3. Place your feet close to the object and 8 to 12 inches apart for good balance.

☐ 4. Bend your knees to a degree that is comfortable.

☐ 5. Grip the box firmly with both hands.

☐ 6. Keeping your back straight and using your leg muscles, lift the box to waist height and hold close to your body.

Caution: Do not make any turning or twisting motions until the lift is complete.

☐ 7. Turn by changing foot position, making sure that your path is clear.

☐ 8. Carry the box to the new location, using a normal walking gait and keeping your view unobstructed.

☐ 9. Reverse the lifting procedure to set the box down, taking care to bend your knees, keep your back straight, and avoid setting the box on your fingers or feet.

Evaluator's Comments: ______________________________

____

____

Objective 23

Job Sheet 2—Operate a Fire Extinguisher

Name ______________________ Attempt Number ________

Date ______________________ Overall Rating ________

Evaluation Criteria	Rating
• Extinguisher was carried properly	______
• User was within stream reach of fire	______
• P-A-S-S sequence was followed	______
• Fire was completely extinguished	______

Basic Skills

Reading Employability

Introduction

Using a portable fire extinguisher properly requires more than simple manipulation. You must always size up the fire and decide whether it can be extinguished with an extinguisher. If the fire is too large or too smoky, call the fire department. If the fire is small enough to be extinguished with an extinguisher, always fight it with your back to a means of escape.

Instructions

When you are ready to perform this task, ask your instructor to observe the procedure and rate your performance using the evaluation criteria.

Tools, equipment, and materials

- Portable fire extinguisher suitable for a Class A fire
- *Small* Class A fire in clear, safe area
- Hose hooked up to a water source and with water in the hose (or another secondary means of extinguishment for backup)

> **Caution:** This procedure should only be performed outdoors on a windless day and only under the direct supervision of your instructor.

Procedure

☐ 1. Pick up the fire extinguisher by its handle.

Note: *All* modern fire extinguishers are designed to be used in an upright position.

☐ 2. Read the fire extinguisher label to determine proper stream reach.

Note: *Stream reach* is the distance the extinguishing agent is propelled. Stream reach varies with extinguisher, and may range from 3 to over 20 feet. Normally, the smaller the extinguisher, the shorter the stream reach.

☐ 3. Walk—do not run—to within stream reach of the fire.

☐ 4. **Pull** the pin at the top of the extinguisher that keeps the handle from being pressed.

Note: Pulling the pin automatically breaks the plastic or thin wire inspection band.

☐ 5. **Aim** the nozzle toward the fire, first releasing it from its clip if applicable.

☐ 6. **Squeeze** the discharge handle (above the carrying handle) to release the extinguishing agent.

Note: The discharge handle can be released at any time to stop the discharge.

☐ 7. **Sweep** the nozzle back and forth at the base of the flames.

☐ 8. After the fire appears to be out, probe for remaining hot spots.

☐ 9. Make sure the fire is out by extinguishing any hot spots.

Evaluator's Comments: ____________________

____

____

Unit Contents

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Objective Sheet

Unit Objective

After completing this unit, the student should be able to interpret a material safety data sheet, apply the safety color code, identify workplace safety violations, and complete a safety inspection of the diesel technology shop. The student should demonstrate these competencies by completing the assignment sheets and by scoring a minimum of 100 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to workplace safety with their definitions.
2. Distinguish among the federal agencies that regulate hazardous materials and hazardous waste.
3. Complete statements concerning OSHA's role in workplace health and safety.
4. Complete statements concerning hazard communication.
5. Describe information on a chemical label.
6. Complete statements concerning purposes of a material safety data sheet (MSDS).
7. List four characteristics of a hazardous material.
8. List three ways hazardous materials can enter the body.
9. Distinguish between the short-term and long-term health effects from exposure to hazardous materials.
10. Identify hazards using the hazardous material diamond classification system.
11. Complete a chart of hazardous materials that may be found in the diesel technology shop.
12. Select from a list the hazardous waste products associated with the diesel technology shop.
13. Complete statements concerning guidelines for storing and disposing of hazardous materials.
14. Distinguish between true and false statements concerning guidelines for using flammable materials and toxic substances.
15. Complete statements concerning equipment and tool safety guidelines.
16. Complete statements concerning electrical safety guidelines.

17. Match the colors of the federal safety color code with their uses.

18. Match safety tags with their color coding.

19. Complete statements concerning general safety guidelines for working on vehicles.

20. Complete statements concerning an overview of asbestos and guidelines for reducing asbestos exposure.

21. Interpret a material safety data sheet. (Assignment Sheet 1)

22. Compile a list of hazardous materials found in your shop and provide additional information on the most common materials. (Assignment Sheet 2)

23. Apply the safety color codes to diesel technology shops. (Assignment Sheet 3)

24. Identify workplace safety violations. (Assignment Sheet 4)

25. Complete an individual student shop safety inspection. (Assignment Sheet 5)

Information Sheet

Objective 1

Terms and definitions

a. **Carbon monoxide**—Colorless, odorless, poisonous gas formed by incomplete combustion

b. **Combustible**—Capable of bursting into flames at temperatures above 100°F

c. **Conductor**—Material that allows the transmission of electricity

Examples: Metals, carbons, water

d. **Corrosive/caustic**—Capable of dissolving metals and/or burning skin and eyes

Example: Battery acid

e. **Electricity**—Fundamental entity of nature usually used as electrical current

f. **Environmental Protection Agency (EPA)**—Federal agency designed to protect our natural resources (air, water, soil, plants, animals, etc.) from contamination due to hazardous and toxic substances

g. **Exposure**—Unprotected contact with a harmful substance

h. **Exposure limit**—Level of a material you can be exposed to each day with no adverse effects

Examples: Threshold limit value (TLV), Permissible Exposure Limit (PEL)

i. **Flammable**—Capable of being easily ignited and burning quickly at temperatures below 100°F

j. **Flash point**—Temperature at which a substance will catch fire

k. **Grounded**—Electrical connection to an object that conducts electrical current to the earth

l. **Hazardous material**—Any substance that could cause injury or death to a person or damage to the environment

m. **Hazardous waste**—Unwanted by-products that are ignitable, corrosive, reactive, or toxic

n. **Insulator**—Material that does not allow the transmission of electricity

Examples: Glass, rubber, plastic

o. **Material safety data sheet** (MSDS)—Form that explains a hazardous material that an employee works with so the employee can safely use the material and respond to emergency situations

p. **Occupational Safety and Health Act** (OSHA)—Federal legislation designed to ensure safe and healthful working conditions for employees

q. **Reactive**—Capable of burning, exploding, or giving off harmful vapors if mixed with air, water, heat, or other materials

Examples: Explosives, oxidizers, unstable chemicals

Note: Reactives should be handled with extreme caution. They can explode under what seem to be safe conditions such as when hot or when being moved.

r. **Solvent**—Chemical that dissolves another substance

Examples: Degreaser, paint thinner, industrial cleaner

s. **Toxic**—Capable of causing illness or death after exposure, even at very low levels

t. **Volatile**—Readily vaporized at a relatively low temperature

Note: Many petroleum products are volatile, and their fumes (vapors) should be avoided.

Objective 2

Federal agencies that regulate hazardous materials and hazardous waste

a. **Occupational Safety and Health Administration (OSHA)**—Regulates hazards in the workplace, including worker exposure to hazardous materials. Regulations are found in CFR 29.

Note: CFR stands for *Code of Federal Regulations.*

b. **Department of Transportation (DOT)**—Regulates the transportation of hazardous materials, including the packaging, labeling, placarding, and transporting (for use or disposal). Regulations are found in CFR 49.

c. **Environmental Protection Agency (EPA)**—Regulates the disposal of hazardous waste. Regulations are found in CFR 40.

Note: In addition to federal regulations, many state and local governments have additional regulations.

Objective 3

OSHA's role in workplace health and safety

a. The Occupational Safety and Health Act was signed on December 29, 1970.

b. The U.S. Department of Labor created the Occupational Safety and Health Administration (OSHA) to oversee the Act.

c. OSHA issues standards and rules for safe and healthful working conditions, tools, equipment, facilities, and processes.

d. OSHA also conducts workplace inspections to assure that standards are followed. Penalties may be levied for noncompliance.

e. OSHA sets two major requirements for employers:

- To provide work and a workplace free from recognized hazards
- To comply with OSHA regulations

f. OSHA sets one major requirement for employees:

- To comply with all occupational safety and health standards and all rules, regulations, and orders issued under the Act.

g. The Act and the standards issued by OSHA apply to every private employer with one or more employees, except for those covered by other federal legislation such as the Atomic Energy Act and the Coal Mine Safety Act.

Objective 4

Hazard communication (HazCom)

a. OSHA established the Hazard Communication Standard (HCS or HazCom) to protect the health and safety of employees.

b. This standard states that employees:

- Have the need and a "right to know" the hazards and the identities of the chemicals they are exposed to when working.
- Also have a need to know what protective measures are available to prevent adverse effects from occurring.

c. OSHA requires employers to develop a written HazCom program including:

- Warning labels on containers
- Material Safety Data Sheets (MSDS) readily available to employees
- Employee training on the proper handling, usage, storage, and transportation of chemicals

Objective 5

Information on a chemical label

a. Chemical name and ingredients

b. Name, address, and phone number of the manufacturer or distributor

c. Procedures for usage, handling, storage, and disposal

d. How to handle spills and leaks

e. Signal words identifying chemical as hazardous

   - Caution—Least severe
   - Warning—Very severe
   - Danger—Most severe

f. Critical first aid instructions and type of fire extinguisher to use

g. Personal protective equipment to wear when using the chemical

h. Other information about the chemical

   Note: Never use a chemical without reading its label. If the label is missing, immediately notify your instructor/supervisor.

   - Flammability
   - Radioactivity
   - Reactivity—Uses words “incompatible,” “unstable,” and “volatile”
   - Toxicity

Objective 6

Purposes of a material safety data sheet (MSDS)

Note: The Federal Occupational Safety and Health Administration, administered by the U.S. Department of Labor, requires employers to keep material safety data sheets on all hazardous substances used by employees. Employees should be aware of their responsibilities and those of their employers concerning access to MSDS information and training.

a. To inform the user of the material's physical properties or fast-acting health effects that make it dangerous to handle

b. To tell the user the level of protective gear needed

c. To tell the user the first aid treatment necessary if exposed to the product or its hazards

d. To tell the management and the user the preplanning needed for safely handling spills, fires, and day-to-day operations with the material

e. To tell the user how to respond to accidents

Objective 7

Characteristics of a hazardous material

Note: If the MSDS or label lists any of these properties or characteristics, then the material is considered hazardous.

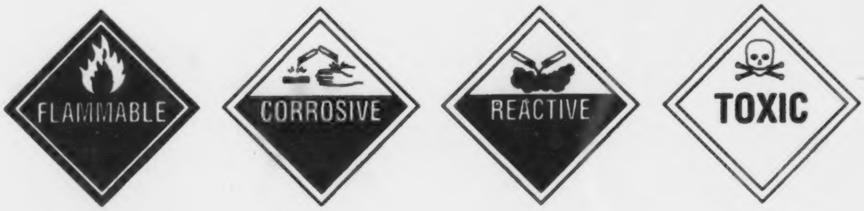
a. Flammable

b. Corrosive

c. Reactive

d. Toxic

Figure 1



Objective 8

Ways hazardous materials can enter the body

a. **Ingestion**—Swallowing by mouth

Example: Swallowing paint thinner

b. **Absorption**—Contacting the skin or eyes

Example: Getting battery acid on your hands

c. **Inhalation**—Breathing in gases, vapors, fumes, or other airborne forms of a material

Example: Inhaling carbon monoxide fumes from equipment exhaust

Objective 9

Health effects from exposure to hazardous materials

Note: Effects from exposure to hazardous materials may be delayed without evidence for years. By then the damage is done and can't be reversed. This is why it is so important to follow all precautions around hazardous materials.

a. **Short-term effects**—Minor symptoms resulting from a brief encounter with a chemical

Examples: Pain, nausea, itching skin, burning eyes, headache, vomiting

b. **Long-term effects**—Severe, ongoing illness resulting from repeated or prolonged encounters with a chemical

Examples: Cancer, asbestosis, emphysema, sterility, kidney damage

Objective 10

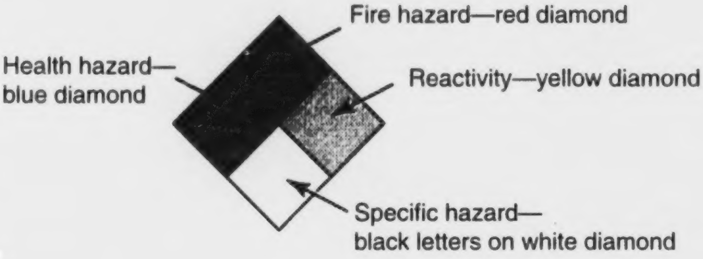
Hazardous material diamond classification system

Note: This system is commonly used on chemical storage containers, as well as vehicles transporting hazardous materials. The diamonds are a quick way to identify how hazardous a chemical is. They are based on the coding system of the National Fire Protection Association (NFPA).

a. The classification system consists of a large diamond made up of four smaller diamonds. Each diamond represents a different characteristic and is represented by a different color.

Diamond Location	Characteristic	Diamond Color
Left-hand diamond	Health hazard	Blue
Top diamond	Fire hazard	Red
Right-hand diamond	Reactivity	Yellow
Bottom diamond	Specific hazard	Black on white

Figure 2


Fire hazard—red diamond
Health hazard—
blue diamond
Reactivity—yellow diamond
Specific hazard—
black letters on white diamond

b. Health, fire, and reactivity hazards are rated according to their severity on a scale of 0–4 with 0 meaning "no hazard" and 4 meaning "severe hazard."

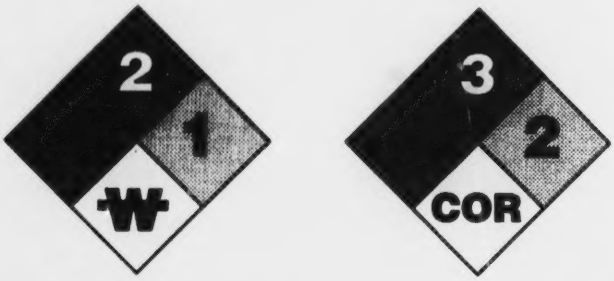
Rating #	Health Hazard Meaning	Fire Hazard Meaning (Flash Points)	Reactivity Hazard Meaning
4	Deadly	Below 73°F	May detonate
3	Extreme danger	Below 100°F	Shock and heat may detonate
2	Hazardous	Below 200°F	Violent chemical change
1	Slightly hazardous	Above 200°F	Unstable if heated
0	Normal material	Will not burn	Stable

c. Other specific hazards are identified with abbreviations or symbols.

Specific Hazard	Abbreviation or Symbol
Oxidizer	OXY
Acid	ACID
Alkali	ALK
Corrosive	COR
Use NO WATER	~~W~~
Radiation hazard	☢

Examples: Chemical #1 Chemical #2

Figure 3



Chemical #1 presents an extreme danger to your health, it will burn below 200°F, and it is unstable if heated. Do not use water on this chemical.

Chemical #2 is a corrosive that is hazardous to your health. It is very flammable with flash point below 100°F, and is capable of violent chemical change.

Note: Remember—The greater the number, the greater the hazard.

Objective 11

Hazardous materials that may be found in the diesel technology shop *(OSHA 29 CFR Parts 1910 H and Z)*

Note: These chemicals will be identified as hazardous ingredients on the MSDS for various products used in the diesel technology shop. Many manufacturers are reformulating their products to eliminate or reduce these hazardous materials. Always check the MSDS to be sure about the content of a product.

Hazardous Material	Common Uses	Dangers
Asbestos	Used as fireproofing insulation in clutch and brake linings and pads	Do not inhale asbestos dust. Can cause serious long-term lung damage and disease.
Benzene	Used in many solvents and in some motor fuels	Avoid all contact and inhalation. Can damage skin, eyes, and nervous system.
Cadmium	Used as protective plating on some bolts and batteries	May be formed into metal dust when cutting or grinding on products made of or covered with this material. Avoid breathing this dust. Can cause serious lung damage.
Carbon monoxide, nitrous oxide, and other exhaust fumes	Unwanted waste products of internal combustion engines	Avoid inhalation. Fumes interfere with body's use of oxygen. Can cause death by suffocation.

Hazardous Material	Common Uses	Dangers
Chlorine and its compounds	Used in many cleaners and chlorinated solvents	Avoid all contact and inhalation. Can damage skin, eyes, and nervous system.
Compressed and liquefied gases, including oxygen, acetylene, butane, propane, hydrogen, refrigerants (R 12 and R134 A), compressed natural gas (CNG), and liquefied petroleum gas (LPG)	Used as fuels and as components of other processes	Handle with care. Pressurized containers may explode. Also avoid breathing fumes.
Ether, ethyl, and its compounds	Used in antifreeze, several solvents, starting fluids, and fuel additives	Avoid all contact and inhalation. Can damage skin, eyes, lungs, and nervous system.
Flammable and combustible liquids, including all products containing petroleum or alcohol	Used as fuels, solvents, thinners, additives, sealants, and lubricants	Avoid contact and inhalation. Can damage skin, eyes, and nervous system. Also use extreme care because all are a fire hazard.
Lead	Used in pipes, cables, batteries, radiators, and solder	May be formed into metal dust when cutting or grinding on products made of this toxic heavy metal. Avoid breathing this dust. Can cause severe damage to the nervous system.
Methyl and its compounds	Used in solvents, paint removers, and adhesives	Avoid contact and inhalation. Can damage skin, eyes, lungs, and nervous system.
Sulfuric acid	Used in battery electrolyte	Avoid contact and inhalation. Can damage skin, eyes, lungs, and nervous system.

Objective 12

Hazardous waste products associated with the diesel technology shop

a. Contaminated water

b. Contaminated fuel

c. Waste oil

d. Waste antifreeze

e. Waste solvent

f. Waste caustic/corrosive

Example: Acids in hot tanks (special parts cleaner)

Objective 13

Guidelines for storing and disposing of hazardous materials

a. Storage

- Refer to the MSDS and your school/company policies for specific storage requirements.
- Store hazardous materials in approved safety containers. These should be tightly closed.
- Store flammable/combustible materials separate from corrosives and reactives.
- Store flammables in temperature-controlled areas away from heat and electric sources.
- Store hazardous materials in locked metal cabinets or locked storage areas.

b. Disposal

- Dispose of hazardous materials according to the MSDS and your school/company policies.
- Use only approved containers for waste disposal. Different containers are used for different waste products.

  Examples: Waste oil in waste oil cans or tanks, waste caustics in caustic tanks
- Never pour hazardous materials into the drain, sewer, or garbage can, or onto the ground.
- If your clothing or other materials are contaminated by hazardous materials (such as spilling fuel or oil on your coveralls), remove the contaminated clothes immediately. Then follow your school/company policies for disposal or decontamination of the clothing.
- The federal government through the Environmental Protection Agency (EPA) monitors hazardous waste disposal to make sure that several environmental laws passed by Congress are followed properly. These laws include the Clean Air Act, Clean Water Act, Safe Drinking Water Act, and the Resource Conservation and Recovery Act.
- Most hazardous waste products are sent to recyclers for disposal. Waste water must be pretreated and then sent to a municipal sewer system.
- The EPA can administer high fines and cleanup costs to businesses that are not disposing of their hazardous waste according to current laws.

- The EPA has also established guidelines to comply with the Clean Air Act for the recovery and recycling of motor vehicle air conditioning refrigerants. EPA-approved equipment must be used by trained and certified technicians who repair or service motor vehicle air conditioners.

Objective 14

Guidelines for using flammable materials and toxic substances (including solvents, corrosives, and reactives)

a. If your hair or clothing catches fire, do **not** run—Stop, drop, and roll to smother the fire, using a blanket if available.

b. Carefully read and follow container label directions before using any flammable liquids or toxic substances. Refer to the MSDS for more detailed information.

c. Wear personal protective equipment (PPE) as specified on the MSDS to prevent eye and skin contact with flammable and toxic substances.

Examples: Chemical splash goggles, respirators, safety gloves, splash aprons, corrosive-resistant boots

d. Use flammable and toxic chemicals in well-ventilated areas. Use fans, exhaust hood, and approved ventilation systems.

e. Avoid breathing toxic fumes or gases. The gaseous vapors from flammable and toxic substances such as solvents and corrosives can cause serious internal damage if you inhale them.

f. Know the location of the right type of fire extinguisher for the chemical you are using. The wrong extinguisher can spread a fire.

g. Know the location of eyewash stations, safety showers, spill control stations, and fresh air supply in case of contamination.

Note: These are for first aid, but contamination victims will also need medical care because their injuries can be very serious, even deadly.

h. Take special care to handle, store, and dispose of flammable and toxic chemicals properly. Refer to the MSDS for detailed information.

i. Use flammable and toxic substances only for their intended purposes.

Example: Don't use gasoline or diesel fuel as a cleaner.

j. Keep flammables, corrosives, and reactives away from fire and sparks. Never smoke, cut, or weld around them.

Objective 15

Equipment and tool safety guidelines

a. Get into the habit of wearing safety glasses all day. Your employer will require it!

b. Always wear eye protection while performing the following operations:

- Grinding, chipping, or drilling
- Welding
- Working under equipment
- Operating abrasive discs
- Charging batteries
- Using caustic cleaning compounds

c. Remove rings and other jewelry when operating power equipment.

d. Secure long hair and loose clothing such as ties, scarves, or wide sleeves when working around power equipment.

e. Obey all safety rules and operating instructions provided by the equipment manufacturer, plus any additional ones used by your shop.

f. Keep tools and equipment clean and in safe working order.

g. Properly store tools and equipment when not in use.

h. Keep guards and safety devices in place on all equipment.

i. Tag and report to the supervisor/instructor any defective tools, machines, or equipment.

j. Turn off power equipment when not in use.

k. Operate equipment only after receiving training on how to use it properly and safely.

l. Use the correct tools for the job to be done.

m. **Never** use compressed air to clean yourself or your clothing. Do not direct compressed air toward another person.

n. Practice this tool motto: “Get, use, and put away.”

Objective 16

Electrical safety guidelines

Note: All electrical equipment is potentially hazardous and can cause fires, explosions, shocks, burns, and even death. Use with care.

a. Do not use any electrical appliance or equipment while you are touching metal or water.

b. Before performing any maintenance task such as oiling or cleaning on electrical equipment, disconnect (unplug) the power from energized tools and tag or lockout machine tools (if trained).

Figure 4a—Tag out

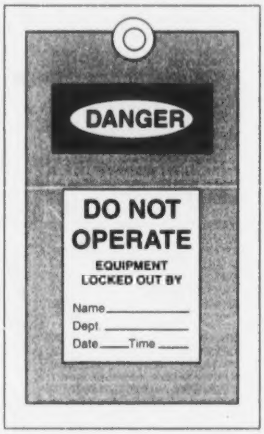
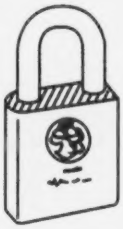


Figure 4b—Lock out



c. Keep electrical equipment and work areas clean to prevent electrical fires. Electrical sparks could ignite any flammable material nearby.

d. Keep access to electrical panels and junction boxes clear.

e. Keep flammable materials away from electrical heat sources, including lights.

f. Know the location of fuses and circuit breakers.

g. Make sure all electrical equipment is properly grounded.

Note: Properly grounded equipment provides a pathway for stray current that may otherwise go through your body!

h. Plug power tools into grounded outlets installed with ground fault circuit interrupters (GFCIs).

i. Never use water on electrical fires.

j. Report any of the following unsafe conditions to your instructor or supervisor immediately and do not use:

- Defective, frayed, or damaged cords
- Shocking, sparking, overheating, or smoking equipment
- Corroded or broken switches or outlets
- Extension cords in permanent use

Objective 17

Colors of the federal safety color code and their uses

Note: The federal safety color code system was put into effect so that dangers and safety equipment could be easily identified by anyone familiar with the code—even if he/she sees the colors in a new location.

a. **Federal safety red**

- Indicates danger
- Identifies fire protection equipment and its location
- Identifies portable containers of flammable liquids
- Identifies emergency stop bars, stop buttons, and electrical stop switches on machinery

b. **Federal safety yellow**

- Indicates caution and marks physical hazards

  Examples: Low beams, steps, pits

- Indicates waste containers for explosive or combustible materials
- Indicates equipment that should **not** be started, used, or moved
- Identifies the starting point or power source for machinery

c. **Federal safety orange**

- Identifies dangerous parts of equipment that could cut, crush, shock, or otherwise injure
- Indicates safety starter buttons

d. **Federal safety purple** (or magenta or black on safety yellow)—Indicates radiation hazards

e. **Federal safety blue**—Identifies tags that indicate equipment that should **not** be started, used, or moved

f. **Federal safety black and white**

- Indicates traffic-flow paths
- Indicates storage areas
- Identifies housekeeping equipment and its location

g. **Federal safety green**

- Identifies safety equipment other than fire fighting equipment and its location
- Identifies first-aid equipment and its location

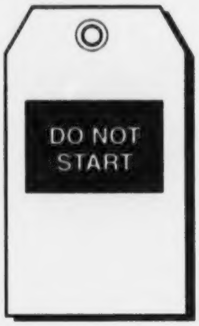
Objective 18

Color coding of safety tags or signs

a. Do not start tag

- White tag
- White letters on red square

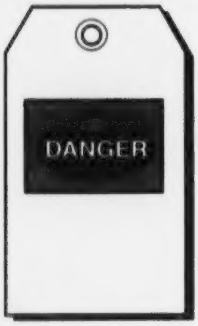
Figure 5



b. Danger tag

- White tag
- White letters on red oval, on black square

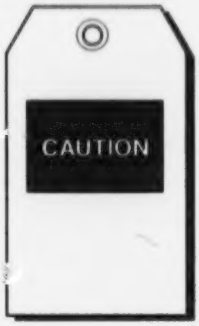
Figure 6



c. Caution tag

- Yellow tag
- Yellow letters on black square

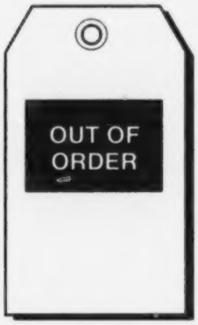
Figure 7



d. Out of order tag

- Blue tag
- White letters on black square

Figure 8



Objective 19

General safety guidelines for working on vehicles

a. Be sure an appropriate fire extinguisher is nearby when starting or running a vehicle in the shop.

b. Be sure vehicle is out of gear before starting it.

c. Use extreme caution when moving a vehicle in the shop. Check around the vehicle and the planned path to make sure there are no obstacles in the way.

d. Use a spotter to help you if trying to maneuver or park a vehicle in a close area.

e. Do **not** leave a vehicle running in the shop without adequate exhaust-removal equipment in place.

f. Be careful about moving parts on the vehicle, such as belts and fans.

Note: Remember that many vehicles have electrically- or air-operated fans that can run any time the switch is on, even if the engine is not running.

g. Be careful about parts that heat up during engine operation.

Examples: Exhaust pipes and manifolds, coolant hoses

h. Do **not** allow tools or other metal objects to contact both battery terminals at the same time.

i. Wear safety glasses, gloves, and protective clothing when handling batteries.

j. Wear your safety belt whenever you ride in or drive a vehicle, including test drives—no matter how short.

k. Avoid using remote starts. Start the vehicle with the ignition switch to ensure proper control.

l. Warn other workers in the area and clear workers from the engine area when starting a vehicle.

Objective 20

Overview of asbestos and guidelines for reducing asbestos exposure *(OSHA 1910.1001, Appendix F)*

a. Asbestos is the name of a class of magnesium-silicate minerals that occur in fibrous form.

b. Asbestos is used in the manufacture of heat-resistant clothing, **automotive brake and clutch linings**, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, fire-resistant drywall, and some insulations.

c. Asbestos can cause disabling respiratory disease (asbestosis) and various types of cancers (lung, stomach, colon) if the fibers are inhaled. Symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

d. The potential for a product containing asbestos to release breathable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers.

e. The permissible exposure limit (PEL) for asbestos is 0.1 fibers per cubic centimeter of air (0.1 f/cc) averaged over the 8-hour workday.

f. OSHA recommends the following practices to reduce asbestos exposure to levels below the PEL:

- Engineering controls (including approved brake cleaning equipment)
- Exposure monitoring (to make sure exposure is below the PEL)
- Respirators and protective clothing (if exposure exceeds PEL)
- Hygiene facilities (clean change rooms, lockers, and showers for containment and decontamination)
- Warning signs and labeling (to regulate areas and caution workers about materials containing asbestos)
- Recordkeeping and medical exams (to monitor employee exposure)

g. In the diesel technology shop, there are two preferred methods for brake and clutch inspection, disassembly, repair, and assembly:

- Negative pressure enclosure with HEPA (high efficiency particulate air) vacuum system
- Low pressure/wet cleaning brake cleaning equipment (most common)

Note: Equivalent methods must be proven to OSHA to be just as effective as the preferred methods.

h. Every effort should be made in the shop to prevent asbestos fibers from becoming airborne.

- Do not clean brake drums or clutches with the air blow gun. That would spread particles all over the shop.
- Use wet rags to wipe off asbestos surfaces.

Student Supplement 1—Guidelines for Interpreting Material Safety Data Sheets

Living in the modern world, you probably are aware that the use of chemicals offers convenience and progress at home and work. Naturally, you want to avoid dangerous overexposure to chemicals, especially on the job. Such overexposure is possible no matter where you work.

Your company's hazard communications, or HazCom, program was created to protect your health and safety. Three important elements are at the heart of your HazCom program: warning labels on containers, training on the safe use and handling of chemicals, and material safety data sheets (MSDSs).

What is on an MSDS

MSDSs are printed pages that give you all the critical information you need about how to use, transport, and store chemicals in order to protect yourself, as well as what to do in case of emergencies and overexposure. Information on MSDSs includes:

- The chemical's name or names
- Name, address, and phone number of the manufacturer
- List of the chemical's ingredients
- Permissible exposure limits (PEL) or threshold limit value (TLV)
- What conditions or other substances will cause the chemical to catch fire, explode, melt, or turn into dangerous gases
- How the chemical usually looks and smells
- How to put out a fire involving the chemical
- What to do if the chemical spills or leaks
- How to prevent dangerous exposure
- Health hazards such as skin irritant or cancer-causing agent
- Symptoms of overexposure
- What to do if you are overexposed
- When the MSDS was prepared

The information for each chemical's MSDS is put together by the manufacturer or distributor for that chemical. The sheets often look different from each other, but they still provide the same information. The law requires your employer to keep MSDSs up to date and to send the MSDS to your doctor or designated representative if you request it.

Where the MSDS is kept

MSDSs must be readily accessible to employees—a posted sign may tell you where, and you can also find out by reading your company's written HazCom program. If you are not sure where to find MSDSs, your supervisor or your company's HazCom contact will make them available to you. It is the law.

Student Supplement 1

When to read an MSDS

You should always read the MSDS *before* you begin a job using a chemical. Even if you have used the chemical before, the manufacturer may have changed its formula, which may change the steps you should take to protect yourself. Taking proper precautions listed on the MSDS, such as wearing a respirator, can prevent serious long-term illnesses.

If you do not understand something on the MSDS, or have questions about your company's HazCom program, ask your supervisor or company contact. Your company knows that HazCom works best if you are fully informed and involved.

How to read an MSDS

The material safety data sheet, or MSDS, is written information that can help protect you from overexposure to chemicals you find on the job. The MSDS is part of your company's hazard communications program. Each company can design its own MSDS form, and the sections may be in a different order. But the basic kinds of information on any MSDS will be the same.

Chemical name (see Figure 1). Lists the identity of the substance (the name on the label, date the MSDS was prepared, the name and address of the manufacturer, and usually a phone number for emergencies and more information).

Hazardous ingredients/chemical identity (see Figure 1). Includes names of substances in the chemical that might be dangerous, and lists safety exposure limits such as permissible exposure limit or PEL (set by OSHA) or the threshold limit value or TLV. Also lists common names for the chemical.

Physical characteristics (see Figure 1). Describes many physical qualities of the chemical, and lets you know what is usual or safe. For example, how the chemical looks and smells;

Figure 1

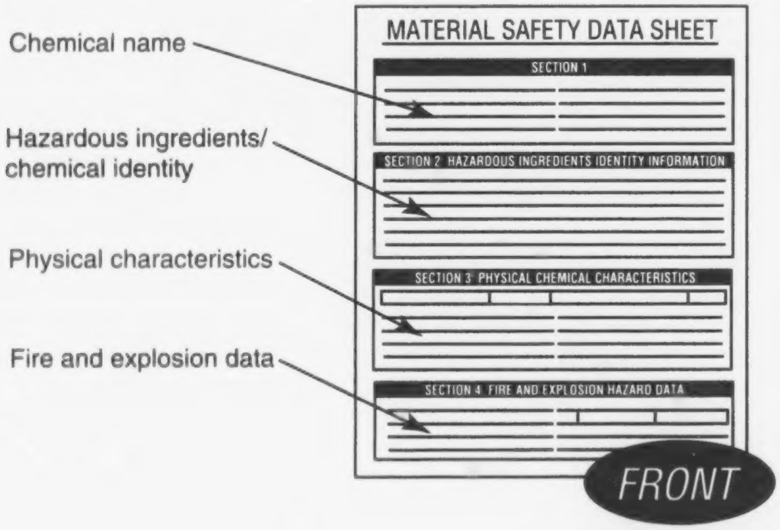
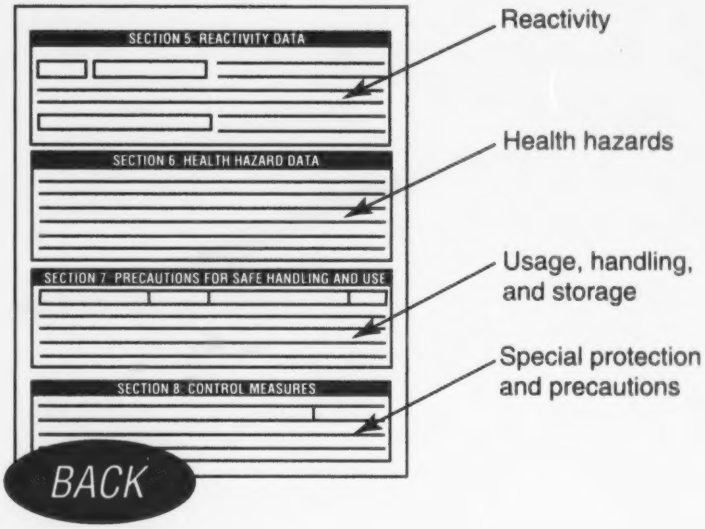

Chemical name
Hazardous ingredients/ chemical identity
Physical characteristics
Fire and explosion data
MATERIAL SAFETY DATA SHEET
SECTION 1
SECTION 2 HAZARDOUS INGREDIENTS IDENTITY INFORMATION
SECTION 3 PHYSICAL CHEMICAL CHARACTERISTICS
SECTION 4 FIRE AND EXPLOSION HAZARD DATA
FRONT

Figure 2


SECTION 5 REACTIVITY DATA
SECTION 6 HEALTH HAZARD DATA
SECTION 7 PRECAUTIONS FOR SAFE HANDLING AND USE
SECTION 8 CONTROL MEASURES
BACK
Reactivity
Health hazards
Usage, handling, and storage
Special protection and precautions

boiling and melting temperatures (important in case a chemical might become a gas you could breathe); evaporation rate (known as percent volatile); how easily the chemical dissolves; and how heavy it is (this tells you if it will sink, float, or dissolve in water).

Fire and explosion data (see Figure 1). Tells you the lowest temperature at which the chemical could catch fire (flash point). Lets you know if it is flammable (catches fire below 100°F) or combustible (catches fire above 100°F). Lists the best way to put out a fire involving that chemical.

Reactivity (see Figure 2). Describes what happens if this chemical comes in contact with air, water, or other chemicals. Describes conditions (like heat) or materials (like water) that can cause the chemical to react by burning, exploding, or releasing dangerous vapors. The chemical is called "incompatible" or "unstable" with these conditions or substances.

Health hazards (see Figure 2). Lists ways the chemical might enter your body, like splashing on your skin or being breathed in as vapor, as well as possible symptoms of overexposure. Lets you know if overexposure might make existing medical conditions worse, and describes emergency first aid procedures.

Usage, handling, and storage (see Figure 2). Describes how to clean up an accidental spill, leak, or release, including special procedures. Tells you how to handle, store, and dispose of chemicals safely. Remember, if there is an accident, notify your supervisor immediately. Take care of it yourself only if you are trained to do so and are wearing the proper equipment.

Special protection and precautions (see Figure 2). Explains special personal protective equipment (PPE) and other equipment to use when working with the chemical, special procedures, extra health or safety information, signs that should be posted, and other information not covered in other sections.

Student Supplement 1

Terms and abbreviations used on MSDSs

The following terms and abbreviations will help you interpret material safety data sheets.

- **TLV**—Threshold limit value; a time-weighted average concentration *under which* most people can work consistently for 8 hours a day, day after day with no harmful effects
- **Ceiling**—Uppermost limit
- **ACGIH**—American Conference of Governmental Industrial Hygienists
- **OSHA**—Occupational Safety and Health Administration
- **PEL**—Permissible exposure limit; the maximum time-weighted concentration *at which* 95 percent of exposed, healthy adults suffer no adverse effects over a 40-hour week
- **ppm**—Parts per million
- **STEL**—Short-time exposure limit; a 15-minute, time-weighted average that should not be exceeded at any time during a workday. Exposures at STEL should not be longer than 15 minutes and should not be repeated more than four times a day with at least 60 minutes between exposures.
- **IDLH**—Immediately dangerous to life and health; material *at* or *above* this level poses an immediate hazard to life or produces immediate, irreversible, debilitating effects
- **LEL**—Lower explosive limit; below the flammability range (too lean to burn)
- **UEL**—Upper explosive limit; above the flammability range (too rich to burn)

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Objective 21

Assignment Sheet 1—Interpret a Material Safety Data Sheet

Name ______________________ Overall Rating __________

Date ______________________

Evaluation Criteria	Rating
• Directions are followed	______
• All questions are answered correctly	______

Basic Skills

Reading Writing Critical Thinking Employability

Directions

Review the material in Objective 6 of the information sheet, and locate and study the information presented in Student Supplement 1, "Guidelines for Interpreting Material Safety Data Sheets."

Use the MSDS at the end of this assignment sheet to answer the following questions. Write your answers on the blanks provided below each item.

1. What is the name of the substance? ______________________
2. What is this product used for?

   ____

3. What are the principal hazardous ingredients in this product?

   ____

   ____

4. What does this product look like?

   ____

5. What percentage of this product is volatile (capable of exploding)?

   ____

6. What extinguishing agents should be used on fires created by this product?

   ____

Assignment Sheet 1

7. What may happen if aerosol containers of this product are exposed to temperatures higher than 130°F?

8. What is the TLV for this product?

9. Are any of the ingredients in this product suspected of causing cancer? Explain.

10. What is the primary way in which this product enters the body?

11. What are the symptoms of overexposure to this product?

12. What first-aid measure should not be taken if this product is ingested?

13. What conditions should be avoided when using this product?

14. What materials should you avoid using with this product?

15. How should you respond to a spill of this product?

16. What special protective equipment and measures should you wear or take when using this product?

17. What special hygiene precautions should you take when using this product?

Assignment Sheet 1

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CLEANER, GRAFFITI GEL
3-15-89

HAZARDOUS COMMUNICATION GUIDE

Material Safety Data Sheet

N/A = Not Applicable
N/D = No Data
N/E = Not Established

Supersedes: *10/20/95*

I. General Information

Data Revised: *12/9/88*

Chemical Name & Synonyms
N/A

Chemical Family
Engine degreaser (gelled)

Proper DOT Shipping Name
Consumer commodity 48580 Sub 3

Manufacturer
Crain Chemical Co., Inc.

Manufacturer's Address
P.O. Box 540995, Dallas, TX 75354

Trade Name & Synonyms
GEL GRAFFITI

Formula
N/A

DOT Hazard Classification
ORM-D

Manufacturer's Phone Number
214/358-3301

Chemtrec Phone Number
1-800-424-9300

II. Ingredients

Principal Hazardous Components	Percent	Threshold Limit Value (units)	
		OSHA	ACGIH
Ethanol *CAS# 64-17-5*	*N/A*	*1000 ppm*	*1000 ppm*
Aromatic Hydrocarbon *CAS# 64742-06-9*	*N/A*	*100 ppm*	*100 ppm*
Chlorinated Hydrocarbon *CAS# 75-09-2*	*N/A*	*500 ppm*	*500 ppm*
Glycol Ethers *CAS# 111-76-2*	*NA*	*50 ppm*	*25 ppm*

III. Physical Data

Boiling Point (°F)
N/A

Vapor Pressure (mm Hg.)
N/D

Vapor Density (Air = 1)
N/E

Solubility in Water
N/A

Appearance & Odor
Opaque, white gel/characteristic odor

Specific Gravity (H_2O = 1)
N/A

Percent Volatile By Volume (%)
77

Evaporation Rate (____ = 1)
N/A

pH
N/A

IV. Fire and Explosion Hazard Data

Flash Point (Test Method)
Flame projection 18" plus

Flammable Limits
Flammable

Extinguishing Media
CO2, Foam

Special Fire Fighting Procedures
Self-contained breathing apparatus

Auto Ignition Temperature
N/E

LEL
N/E

UEL
N/E

Unusual Fire & Explosion Hazards
Do not expose aerosols to temperatures above 130°F or the container may rupture.

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3-15-89

HAZARDOUS COMMUNICATION GUIDE

V. Health Hazard Data

Threshold Limit Value
50 ppm

OSHA Threshold Limit Value
See Section II

ACGIH Threshold Limit Value
See Section II

Carcinogen - NTP Program
Chlorinated hydrocarbon (animal data only)

Carcinogen - IARC Program
Same as (NTP)

Symptoms of Exposure
Headaches, dizziness, irritation, burning (eyes), nausea, asphyxia and possible chemical pneumonitis if aspirated into lungs.

Medical Conditions Aggravated by Exposure
May aggravate existing eye, skin, or upper respiratory conditions.

Primary Route(s) of Entry
Inhalation

Emergency First Aid
Eyes: Flush with water for 15 minutes. If irritated, see physician. Skin: Wash with soap and water. If irritated, see physician. Inhalation: Move to fresh air. Resuscitate if necessary. Get medical aid. Ingestion: Do NOT induce vomiting. Call physician immediately.

VI. Reactivity Data

Stability		Unstable
	X	Stable
Incompatibility		
Hazardous Polymerization		May Occur
	X	Will Not Occur

Conditions to Avoid
Heat, sparks, welding arcs, open flames

Materials to Avoid
Strong oxidizing agents

Conditions to Avoid
None known

Hazardous Decomposition Products
CO_2, CO, HCL, Small amounts of phosgene and chlorine

VII. Environmental Protection Procedures

Spill Response
Absorb with suitable medium. Incinerate or land fill according to local, state, or federal regulations. Do not flush to sewer.

Waste Disposal Method
Aerosol cans, when vented to atmospheric pressure through normal use, pose no disposal hazards.

VIII. Special Protection Information

Eye Protection
Safety glasses recommended

Respiratory Protection (Specific Type)
If vapor conc. exceeds TLV, use respirator approved by U.S. Bureau of Mines for organic vapor.

Other Protection
None

Skin Protection
Neoprene gloves recommended

Ventilation Recommended
Adequate ventilation to keep vapor concentration below TLV.

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3-15-89

HAZARDOUS COMMUNICATION GUIDE

IX. Special Precautions

Hygienic Practices in Handling & Storage
Wash with soap and water before handling food. Do not puncture or incinerate containers. Do not store at temperatures above 130° F.

Precautions For Repair & Maintenance of Contaminated Equipment
Remove all ignition sources i.e., heat, sparks, open flames, etc.

Other Precautions
Avoid food containers. Keep out of reach of children. Remove ignition sources. Avoid breathing vapors.

Objective 22

Assignment Sheet 2—Compile a List of Hazardous Materials Found in Your Shop and Provide Additional Information on the Most Common Materials

Name ______________________ Overall Rating __________

Date ______________________

Evaluation Criteria	**Rating**
• Directions are followed	______
• Materials are listed correctly	______
• Chart is completed correctly	______

Basic Skills

Reading Writing Critical Thinking Employability

Directions

Make a list of the chemical names of all the hazardous materials found in your diesel technology shop. MSDSs should be available on all of these hazardous materials. Then complete the chart about the five most commonly used hazardous materials in your shop.

Hazardous Materials in Diesel Technology Shop (list all)

1. ______________________
2. ______________________
3. ______________________
4. ______________________
5. ______________________
6. ______________________
7. ______________________
8. ______________________
9. ______________________
10. ______________________
11. ______________________
12. ______________________
13. ______________________
14. ______________________
15. ______________________
16. ______________________
17. ______________________
18. ______________________
19. ______________________
20. ______________________

Assignment Sheet 2

	Chemical Name	How it is Used in Shop	PPE Required Before Using
1.			
2.			
3.			
4.			
5.			

Objective 23

Assignment Sheet 3—Apply the Safety Color Codes to Diesel Technology Shops

Name ______________________ Overall Rating ________

Date ______________________

Evaluation Criteria	Rating
• Directions are followed	____
• All items are correctly color-coded (Parts A & B)	____
• All shop items are included (Part B)	____
• Layout is neat and legible (Part B)	____

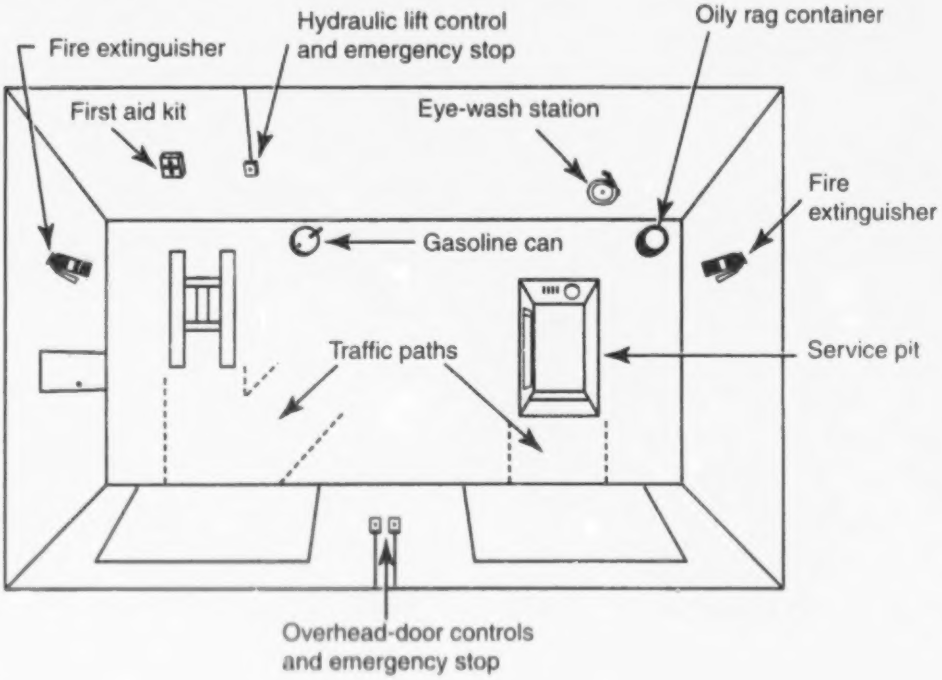
Basic Skills

Reading Critical Thinking Employability

Part A: Given Shop

Directions

Look at the drawing below of a small diesel technology shop. A number of items that require federal safety color coding are labeled. Indicate what color the items should be either by writing in the correct color or by coloring it as it should be coded.


Fire extinguisher
Hydraulic lift control and emergency stop
Oily rag container
First aid kit
Eye-wash station
Fire extinguisher
Gasoline can
Traffic paths
Service pit
Overhead-door controls and emergency stop

Assignment Sheet 3

Part B: School Shop

Directions

Draw a layout of your school shop below including all machines, workbenches, tools, first aid kit, and fire prevention equipment. Use the federal safety color code to identify equipment, hazards, safety features, and exposed parts that could cause accidents.

Objective 24

Assignment Sheet 4—Identify Workplace Safety Violations

Name ____________________ Overall Rating __________

Date ____________________

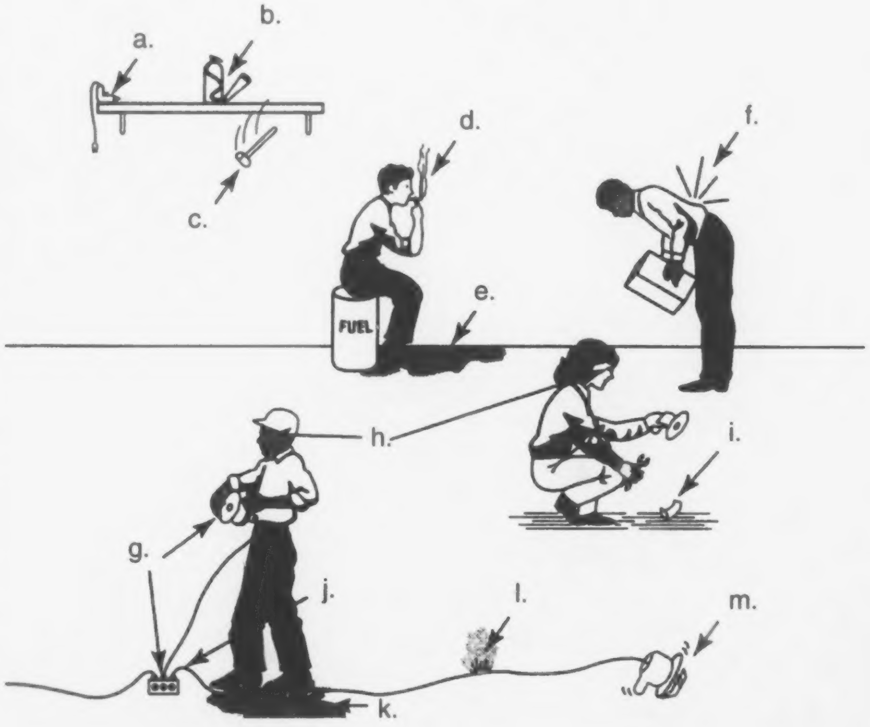
Evaluation Criteria	Rating
• Directions are followed	______
• 8 of 13 violations are correctly identified	______

Basic Skills

Reading Critical Thinking Employability

Directions

The following illustration of a diesel shop shows thirteen hazardous situations or dangerous practices. Identify at least eight of these safety violations and list them on the next page.



a. ______________________________

b. ______________________________

c. ______________________________

d. ______________________________

e. ______________________________

f. ______________________________

g. ______________________________

h. ______________________________

i. ______________________________

j. ______________________________

k. ______________________________

l. ______________________________

m. ______________________________

Remember to identify at least 8.

Objective 25

Assignment Sheet 5—Complete an Individual Student Shop Safety Inspection

Name ______________________ Overall Rating __________

Date ______________________

Evaluation Criteria	**Rating**
• All listed items are inspected correctly	_____
• Recommendations are made for all unsatisfactory conditions	_____

Basic Skills

Reading Critical Thinking Employability

Directions

Complete the safety inspection checklist by physically conducting an inspection of the shop area. Draw a circle around the appropriate letter, using the following letter scheme:

S—Satisfactory (needs no attention)
A—Acceptable (needs some attention)
U—Unsatisfactory (needs immediate attention)

Recommendations should be made in all cases where a "U" is circled. Space is provided at the end of the form for such comments.

A. General Physical Condition

S A U 1. Machines, benches, and other equipment are arranged to conform to good safety practices.
S A U 2. Stairways and ramps are clean and in good condition.
S A U 3. Aisles are clear and in good condition.
S A U 4. Floors are clean and in good condition.
S A U 5. Walls, windows, and ceiling are clean and in good condition.
S A U 6. Illumination is safe, sufficient, and well placed.
S A U 7. Ventilation is adequate and proper for conditions.
S A U 8. Room temperature is controlled and comfortable.
S A U 9. Fire extinguishers are of proper type, adequately supplied, properly located, and properly charged.
S A U 10. First aid kit is adequately supplied and properly located.
S A U 11. Number and location of exits are adequate and properly identified.
S A U 12. Safety rules are posted.

S A U 13. Emergency numbers are posted by telephone.
S A U 14. Walls are clear of objects that might fall.
S A U 15. Utility lines are properly identified.
S A U 16. Air in shop is free from excessive dust and smoke.
S A U 17. Hazardous materials are clearly labeled.
S A U 18. MSDSs are readily available for all hazardous materials in shop.
S A U 19. Eyewash stations/showers are in or near the shop area for emergency first aid use.
S A U 20. Evaluation for the overall rating of GENERAL PHYSICAL CONDITION

B. Housekeeping

S A U 1. Storage space for tools and materials is adequate.
S A U 2. Benches are kept orderly.
S A U 3. Corners are clean and clear.
S A U 4. Special tool racks, in orderly condition, are provided at benches and machines.
S A U 5. Tool, supply, and/or material room is orderly.
S A U 6. Sufficient scrap boxes and trash cans are provided.
S A U 7. Materials are stored in an orderly and safe condition.
S A U 8. Hazardous waste containers are closed and clearly identified.
S A U 9. Hazardous waste is separated according to type.
S A U 10. Hazardous materials have been stored in metal cabinets and locked from general access.
S A U 11. Machines have been color coded.
S A U 12. Safety storage cans are provided for flammable liquids.
S A U 13. Floors are free of oil, water, and foreign material.
S A U 14. Drain covers are securely in place.
S A U 15. Evaluation for the overall rating for HOUSEKEEPING

C. Equipment

S A U 1. Machines are arranged so that workers are protected from hazards of other machines and passing students.
S A U 2. Danger zones are properly indicated and guarded.
S A U 3. All gears and moving belts are protected by permanent enclosure guards.
S A U 4. All equipment control switches are easily available to operator.
S A U 5. Nonskid areas are provided around machines.
S A U 6. Tools are kept sharp, clean, and in safe working order.
S A U 7. Evaluation for the overall rating for EQUIPMENT

D. Electrical Installation

S A U 1. All switches are enclosed.
S A U 2. There is a master control switch for all of the electrical installations.
S A U 3. All electrical extension cords are in safe condition and are not carrying excessive loads.

S A U 4. All machine switches are within easy reach of the operators.
S A U 5. Individual cut-off switches are provided for each machine.
S A U 6. All electrical equipment is properly grounded.
S A U 7. Ground fault interrupters are present and in working order.
S A U 8. No temporary wiring is in evidence.
S A U 9. Evaluation for the overall rating for ELECTRICAL INSTALLATION

E. **Personal Protection** (Read only)

1. Safety glasses, goggles, or protective shields are provided and required for all work where eye hazards exist.
2. Shields and goggles are provided for welding.
3. Rings and other jewelry are removed by students when working in the shop.
4. Proper kind of apparel is worn and worn properly for the job being done.
5. Leggings and safety shoes are worn in special classes.
6. Students are tested for safety knowledge ability.
7. Sleeves are rolled above elbows when operating machines.
8. Student's loose clothing such as ties, scarves, and loose sleeves are secured.

Recommendations for Improving Unsatisfactory Conditions

Unit Contents

Student Components

Student Page

Objective Sheet 3–3

Information Sheet 3–5

Assignment Sheet

1—Determine Basic First Aid Measures for Given Emergency Situations 3–25

Objective Sheet

Unit Objective

After completing this unit, the student should be able to describe the steps for giving first aid and determine the basic first aid measures for given emergency situations. The student should demonstrate these competencies by completing the assignment sheet and by scoring a minimum of 100 percent on the written test.

Specific Objectives

After completing this unit, the student should be able to:

1. Match terms related to first aid with their definitions.
2. List major causes of accidents.
3. State injuries that may occur in the diesel shop according to their sources of accidents.
4. Match basic types of accident injuries with their descriptions.
5. Describe in the correct order the steps for giving first aid.
6. List times to call for emergency medical service.
7. Select from a list the information to give during an emergency phone call.
8. Distinguish between true and false statements concerning legal aspects of first aid.
9. Match the contents of a first aid box with their uses.
10. Complete statements concerning bloodborne pathogens and special first aid precautions.
11. Complete statements concerning basic first aid procedures for various emergencies.
12. Arrange in order the steps on how to treat choking.
13. Distinguish between true and false guidelines for giving mouth-to-mouth breathing.
14. Complete statements on the basic steps for performing cardiopulmonary resuscitation.
15. Determine basic first aid measures for given emergency situations. (Assignment Sheet 1)

Information Sheet

Objective 1

Terms and definitions

a. **Accident**—Suddenly occurring, unintentional event that causes injury or property damage

b. **Acquired Immune Deficiency Syndrome (AIDS)**—Life-threatening bloodborne disease that depresses the immune system; caused by the human immunodeficiency virus (HIV); is eventually fatal

c. **Airway obstruction**—Blockage of the airway that prevents air from reaching a person's lungs

d. **Anaphylactic shock**—Severe and sometimes fatal reaction to a substance such as a food, drug, or insect venom; characterized by respiratory distress, fainting, and itching

e. **Antiseptic**—Substance that blocks or slows the growth of certain microorganisms but does not kill them

f. **Arteries**—Blood vessels that carry oxygen-rich blood **from** the heart to all parts of the body

g. **Bloodborne pathogen**—Disease-causing microorganism found in infected blood and blood products

h. **Cardiopulmonary resuscitation (CPR)**—Technique used to restore circulation and breathing for a victim whose breathing and heart have stopped; combines chest compressions (cardio-) and mouth-to-mouth breathing (pulmonary)

i. **Carotid arteries**—Major blood vessels that supply blood to the head and neck

Note: Blockages in these arteries cause strokes. These are the arteries commonly felt for when taking a pulse.

j. **Choking**—Blockage of the airway by food, fluids, or other foreign objects

k. **Consent**—Permission to provide care, given by the victim to the rescuer

l. **Coronary arteries**—Blood vessels that supply the heart muscle with oxygen-rich blood

Note: Blockages in these arteries cause heart attacks or cardiac arrests.

m. **Diabetes**—Condition in which the body does not produce enough insulin

n. **Emergency medical service (EMS)**—Trained and equipped personnel dispatched through a local emergency number to provide emergency care for ill or injured people

o. **Epilepsy**—Chronic condition characterized by seizures that vary in type and duration; can usually be controlled by medication

p. **First aid**—Immediate care given to a victim of injury or sudden illness until more advanced care can be obtained

q. **Heimlich maneuver**—Procedure for forcing a foreign object from the airway of a choking victim

r. **Hepatitis**—Infectious disease marked by inflammation of the liver; several types; severe cases may be fatal

s. **Injury**—Condition that occurs when the body is subjected to an external force

t. **Medical emergency**—Sudden illness requiring immediate medical attention

Examples: Heart attack, stroke, diabetic coma, epileptic seizure

u. **Pressure points**—Sites on the body where pressure can be applied to major arteries to slow the flow of blood to a body part

v. **Pulse**—Beat felt in arteries with each contraction of the heart

w. **Trauma**—Wound or injury caused by violence or excessive physical force

x. **Unconsciousness**—State in which a person experiences no sensory impressions

Note: A victim who is unconscious may look asleep but you cannot awaken them.

y. **Veins**—Blood vessels that carry oxygen-poor (dark red) blood from all parts of the body back to the heart

Objective 2

Major causes of accidents

Note: Ninety-eight percent of all accidents and injuries are caused by one or a combination of the following causes. Only 2% of accidents are attributed to unpreventable acts of nature.

a. **Unsafe acts**

- Cleaning, oiling, adjusting, or repairing of moving, energized, or pressurized equipment
- Failure to receive proper instruction

- Failure to use personal protective equipment
- Failure to secure area or warn others of danger
- Horseplay, quarreling, or fighting
- Ignoring instructions or operating without permission or authority
- Improper use of equipment
- Improper use of hands or body parts
- Inattention to footing or surroundings
- Operating or working at unsafe speed
- Removing safety devices
- Using unsafe equipment

b. **Unsafe personal factors**

- Being under the influence of alcohol/drugs
- Fatigue
- Illness
- Improper attitude
- Lack of job knowledge or skill

c. **Unsafe conditions**

- Defective tools, equipment, substances
- Dress or apparel hazard
- Environmental hazards such as temperature extremes or contaminated air
- Hazardous methods or procedures
- Inadequately guarded machines or area
- Improper illumination
- Improper storage of hazardous and flammable materials
- Poor housekeeping

Information Sheet

Objective 3

Sources of accidents in the diesel shop and injuries that may occur

a. Horseplay—May cause others to fall against sharp objects or moving machinery

b. Air hose—One blast may rip clothing or skin

c. Grinder—May cause eye or face injury from flying sparks or metal chips

d. Batteries—May explode when near open flame or electrical spark

e. Moving parts—May catch fingers or clothing

f. Loose clothing—May catch in rotating parts

g. Tools—Sharp edges may puncture skin

h. Electrical power tools—May cause shock if not grounded

i. Lack of or improper supporting device under heavy objects—A fall may cause a fatal injury.

j. Lifting heavy objects—May cause severe back injury

k. Welding—May cause injury to eyes and to skin if protective equipment is not worn

l. Pneumatic tools—High air pressure may seriously damage eyes and skin.

m. Spills on the floor—May cause falls

Objective 4

Basic types of accident injuries

a. **Amputation**—Loss of an arm or leg

b. **Burn**—Tissue damage caused by fire or heat (thermal), chemicals, electricity, or certain radiations

c. **Contusion, bruise**—Tissue damage caused by force (blunt trauma); broken blood vessels under the skin cause discoloration (black or blue)

d. **Dislocation**—Displacement of a bone at a joint

e. **Electric shock, electrocution**—Nerve and muscle damage caused by electricity traveling through the body; may cause burns and death (electrocution) if the heart is stopped by the electricity

f. **Exposure to severe weather (frostbite, heat stroke, heat exhaustion, sunstroke)**—Various types of damage to the body caused by extremely high or low temperatures; victim may be unconscious

g. **Foreign body**—Entrance of an abnormal substance into the body

Examples: Dust particles in the eye, rust fragments under the skin, debris in an open wound

h. **Fracture**—Broken bone; may be closed (below the skin) or open (protruding through the skin)

i. **Internal injury**—Damage to abdominal or pelvic body organs, usually caused by force

j. **Open wound (cut, laceration, puncture, abrasion)**—Break in the skin's surface, usually with bleeding involved

k. **Sprain, strain**—Twisting or wrenching of a joint (sprain) or a muscle (strain), usually with ligament damage also involved

Objective 5

Steps for giving first aid (listed in order)

a. **Primary steps of first aid**

Note: These are the steps you should do first when you find someone who is seriously injured or sick.

- **Make sure the victim is in a safe place.** Never move victims unless they are in danger where they are such as from fire, traffic, or dangerous fumes. You can hurt victims even more by moving them.

  Note: There may also be dangers present that will prevent you from helping the victim such as downed power lines or deep or swift-moving water. Call emergency medical services if you cannot help.

- **Check the victim's breathing.** Check the airway to see if it is clear. If the victim is not breathing, give mouth-to-mouth breathing.

- **Check the victim's circulation.** Check their pulse on the wrist or on the carotid artery (side of the neck) to see if their heart is still beating. If their heart has stopped, begin CPR if you are trained.

- **Stop any severe bleeding.** Put on your first aid gloves, and then apply pressure to the wound or to a pressure point.

Note: These four steps listed above can help save a life. Now go on to the secondary steps to help prevent further injury.

b. **Secondary steps of first aid**

- **Call for emergency medical help or have someone else make the call.** Emergency numbers should be posted by the phone or listed in the front of the phone book. 911 is used in many cities. Also call for your instructor or supervisor.

- **Always have a reason for what you do.** Never try to do anything you have not been trained to do. Be sure that what you are doing will help and not hurt the victim.

- **Stay calm. Talk to the victim.** You want to reassure the victim that someone knows they are hurt and that something is being done.

- **Ask the victim what happened and where he/she is hurt**. If the victim is unconscious but breathing, begin to check from head to toe for injuries.
- **Check for a medical alert bracelet, necklace, or wallet card.** This may be worn by someone with a serious medical condition such as epilepsy, diabetes, heart disease, or allergies.
- **Take care of other injuries** (broken bones, burns, cuts, etc.).

Note: First aid is only intended to help until a doctor or other trained person can take over.

Objective 6

Times to call for emergency medical service (EMS)

Note: It's better to be safe than sorry. If you are not sure how serious the injury is or do not know what to do, call for emergency help.

When the victim:

a. Is unconscious, unusually confused, or seems to be losing consciousness

b. Has trouble breathing, is breathing in a strange way, or is not breathing

c. Has persistent chest pain or pressure

d. Has pressure or pain in the abdomen that does not go away

e. Is vomiting or passing blood

f. Has seizures, severe headache, or slurred speech

g. Appears to have been poisoned

h. Has injuries to the head, neck, or back

Objective 7

Information to give during an emergency phone call

Note: Speak slowly and clearly. Shouting is difficult to understand.

a. What happened—Tell the nature of the emergency.

Examples: Man is bleeding severely, women has fallen off a ladder and is unconscious, man is having a heart attack, woman has a chemical burn, etc.

b. How many are involved—This tells them how many rescue squads to send.

c. Where victim is located—Give city, street name, street number, description of building, whatever will help find the victim.

d. What help (first aid) is being given

e. Your name

f. Phone number where you are calling from

g. Do not hang up until the dispatcher hangs up—The emergency dispatcher may have other questions or be able to give you advice or instructions on what to do.

Objective 8

Legal aspects of first aid

a. Under most situations, you are not **legally** obligated to give first aid.

b. However, once you start first aid, you cannot stop until you can turn over their care to others of equal or greater competence such as trained medical emergency workers or experienced supervisors or coworkers or until the victim refuses treatment.

c. You must tell the victim who you are, how much training you have, and how you plan to help.

d. Consent should be obtained from every conscious, mentally competent adult. Oral consent is valid.

e. Consent should be obtained from the parent or guardian of a child or mentally incompetent adult.

f. Do not give first aid if the victim refuses to consent.

g. Consent is implied for giving emergency life-saving first aid to an unconscious victim.

h. Good Samaritan laws protect first aiders in most states if you are acting in good faith and without gross negligence or willful misconduct.

Note: You cannot force first aid on anyone. A police officer is the only person with the authority to restrain and transport a person against the person's will. Even at the hospital, the victim will have to give permission for medical care.

Objective 9

Contents of a first aid box (or kit)

Note: Other items may be included such as cold packs and elastic bandages. A basic first aid guide book is also helpful.

a. Adhesive bandages (such as Band-Aids®), various sizes—Used for covering small wounds

b. Adhesive tape, roll—Used for securing the dressing or bandage

c. Alcohol or antiseptic wipes—Used to cleanse a wound area or your hands

d. Antiseptic skin ointment—Used to prevent infection, especially for minor cuts

e. Face shield or mask—Used to act as a barrier between the victim and the first aider when giving mouth-to-mouth breathing

f. Gauze bandage, roll—Used for wrapping around a wound or for holding a larger dressing on the wound area

g. Gauze dressings or pads, individually wrapped—Used for cleaning and covering wounds

h. Gloves, disposable (latex or vinyl)—Used to act as a barrier between the victim and the first aider when blood and body fluids are present

i. Scissors—Used to cut bandages and tape

j. Tweezers—Used to remove splinters or insect stingers

Objective 10

Bloodborne pathogens and special first aid precautions

a. In any situation involving blood or body fluids, there is a small, but real, risk of infection from very serious bloodborne pathogens.

b. Bloodborne pathogens are disease-causing microorganisms carried in the blood. These include:

   - HIV (human immunodeficiency virus), which eventually develops into AIDS (acquired immune deficiency syndrome), a fatal disease, and
   - Hepatitis B (HBV), a virus that causes serious and sometimes fatal liver disease.

c. Special precautions must be followed to protect you when giving first aid.

   - Treat all victims as if they were infected because you cannot tell by looking at someone if they are infected with HIV or HBV.
   - Always wear latex or vinyl rubber gloves as a barrier. These should be included in every first aid kit. If latex gloves are not available, use the most waterproof material available (such as plastic bags) or extra gauze dressings to form a barrier.
   - Cover all wounds with dressings to prevent both the victim and the first aider from coming in contact with each other's blood.
   - Use face masks with a one-way valve for protection when doing mouth-to-mouth breathing, especially if there is blood in the mouth. Every first aid kit should have one.
   - Do not eat, drink, or touch your mouth, nose, or eyes when giving first aid.

d. Special clean-up procedures must also be followed.

   - Vigorously wash your skin in hot, soapy water, and rinse well.

- Notify designated personnel in your facility to clean up any materials or surfaces contaminated by blood or body fluids. They will:
  - Wash all clothing and other items contaminated by blood or body fluids in hot, soapy water.
  - Wash floors and other blood-contaminated surfaces with a solution of one part liquid chlorine bleach to nine parts of water, and rinse well.
  - Dispose of cleanup materials properly in plastic biohazard bags.

Note: If you have other questions, call the national AIDS hot line at 1-800-342-AIDS.

Objective 11

Basic first aid procedures for various emergencies

Note: These are the specific things you can do while you are waiting for emergency help. Keep in mind the basic first aid procedures as well.

a. **Bleeding**

- Minor bleeding
  - Apply antiseptic solution.
  - Dress with sterile bandages.
- Severe bleeding
  - Apply pressure dressing or manual pressure to wound.
  - If bleeding still does not stop, apply pressure to appropriate pressure points—Brachial arteries for arms and hands, femoral arteries for legs and feet
  - Watch for signs of shock. Treat as necessary. (See shock.)

b. **Broken bones**

- Open fractures (bone has broken through the skin surface)
  - Control bleeding.
  - Cover bone and wound with a dressing.
  - Do not try to push the bone back into place.
  - Do not try to clean the cut.
  - Do not move the victim. If the victim must be moved, splints should be applied from the joint above to the joint below the break.

- Closed fracture (bone has not broken skin surface)
  - Check for swelling, deformity, pain/tenderness, loss of use, or grating sensation. These are indications of fractures.
  - Immobilize the break using splints, slings, or wraps.
  - Do not move the victim.
- Spinal injuries (neck or back)
  - Do not move the victim.
  - Do not let the victim try to move.
  - Call for help immediately.

c. **Burns**

- First-degree thermal burn—Burn affecting only the outer skin layers; characterized by redness and pain
  - Hold under cold water.
  - Apply dry, sterile dressing.
- Second-degree thermal burn—Burn penetrating beneath the superficial skin layers; characterized by swelling and blisters
  - Cool with a damp compress.
  - Cover with a dry, sterile dressing to prevent infection.
  - Do not break blisters.
- Third-degree thermal burn—Burn that destroys all skin layers and underlying tissue; characterized by white, leathery appearance and lack of pain
  - Cool with a damp compress.
  - Cover with a dry, sterile dressing.
  - Do not put oil, butter, ointments, or any kind of medicine on a serious burn.

    Note: These will have to be scraped off at the hospital and may cause further complications.
- Chemical burn
  - Flush skin thoroughly with clean water.
  - Check MSDS for more first aid instructions.
  - Apply dry, sterile dressing.

- Electrical burn
  - — Locate both the entrance and exit burns.
  - — Treat as for a third-degree burn.

d. **Convulsion** (including epileptic seizure)

Note: A convulsion may occur at the onset of a serious infectious disease or because of a head injury, brain disease, or epilepsy.

- Help victim lie on the ground or floor if possible.
- Clear area of hard or dangerous objects to protect the victim from self-injury.
- Turn victim to the side to allow saliva to drain from the mouth.
- Give mouth-to-mouth breathing if necessary.
- Do not try to restrain victim.
- Do not place a blunt object between the victim's teeth.
- Do not pour liquids into victim's mouth.

e. **Electrical accident**

- Do **not** provide any medical assistance until all electrical current has been shut off.

> **Caution:** If the victim is still in contact with a live electrical hazard, do not endanger yourself by touching the victim, metal objects, water, or the wet ground. You may become a victim yourself as the current passes into your body.

- Check breathing and pulse. Perform mouth-to-mouth breathing or CPR if necessary and if qualified.
- Watch for signs of traumatic shock. Treat as necessary. (See shock.)
- Check for signs of electrical burns at entrance wound and exit wound. Treat as necessary. (See burns.)

f. **Eye injury**

Note: Even though damage may be confined to one eye, it is sometimes best to bandage both eyes with a sterile dressing so the victim will not have a tendency to move the damaged eye.

- Minor
  - — Have the victim close his/her eyes, and put a piece of moist cotton over the closed lid.
  - — Place a bandage over the cotton.

- More severe injury
  - Have the victim close his/her eyes, and apply a sterile dressing.
  - Place a loose bandage over the dressing.
  - Do not allow the victim to rub his/her eye.
- Chemical injury—Flush eyes immediately at an eye-flushing station, or use a bottled, portable flushing solution.

g. **Falls**

- Head injury
  - Lay victim flat.
  - Check breathing and pulse. Perform mouth-to-mouth breathing or CPR if necessary and if qualified.
  - Control bleeding.
- Less severe falls
  - Check for injury and provide first aid as appropriate.
  - Do not move victim or allow victim to move if a neck or back injury is suspected.

h. **Heart attack**

- Recognize the signs and symptoms of heart attack:
  - Chest pain (most common symptom) that may radiate to the arms, neck, jaw, and upper back
  - Profuse sweating and chills
  - Nausea, vomiting, indigestion
  - Difficulty and pain in breathing
  - Weakness
  - Apprehension
  - Pale or blue-looking skin, lips, or nails
- Help victim to a less painful position.
- Loosen victim's clothing around the neck and midriff (abdomen).
- Check breathing and pulse. Perform CPR if necessary and if qualified.

i. **Heat exhaustion**

- Recognize the signs and symptoms of heat exhaustion:
  - — Approximately normal body temperature
  - — Profuse perspiration
  - — Pale, clammy skin
  - — Rapid, weak pulse
  - — Rapid, shallow breathing
- Move victim to a cool place.
- Have victim lie on back.
- Elevate victim's feet slightly (8–12″).
- Loosen victim's clothes.
- Sponge victim with cool water.
- Give cool water to drink.

j. **Heat stroke**

- Recognize the signs and symptoms of heat stroke:
  - — High body temperature (105°F or higher)
  - — Little or no perspiration
  - — Red skin
  - — Rapid pulse
  - — Rapid, shallow breathing
  - — May be unconscious
- Move victim to a cool location.
- Cool victim as quickly as possible. Remove victim's outer clothing and sponge bare skin with cool water or rubbing alcohol.
- Place cold packs at neck, armpits, head, and groin.
- Use fans for additional cooling.
- Give cool water to drink, if conscious.

k. **Insect bites/stings** (from bees, wasps, spiders, etc.)

- Ordinary reaction
  - Scrape stinger sideways away from wound or remove with tweezers.
  - Wash wound with soap and water.
  - Apply cold pack (or ice) to reduce swelling.
- Allergic reaction

  Note: A victim with an allergic reaction to the insect poison may suffer anaphylactic shock and needs prompt treatment with epinephrine by injection or inhalation.

  - If possible, immediately transport victim to a hospital or doctor's office.
  - If not possible, call for emergency medical help.
  - While waiting for help:
    - Lay victim down or help the victim to a position in which he or she can breathe more easily.
    - Elevate victim's legs if possible.
    - Remove the stinger and perform first aid actions as for an ordinary sting.
    - Check breathing and pulse. Perform mouth-to-mouth breathing or CPR if necessary and if qualified.

l. **Shock, traumatic**

Note: Shock may occur with any type of injury. Even though the injury itself may not be serious enough to cause death, death may occur from shock resulting from an injury.

- Recognize the signs and symptoms of shock:
  - Damp (clammy), very cold, pale skin
  - Fast, weak, uneven pulse
  - Fast, shallow, uneven breathing
  - Weakness
  - Thirst
  - May be unconscious
- Lay victim down on his/her back (preferred) or side if vomiting occurs.

- Elevate victim's legs slightly (8–12") if there are no neck, back, or hip injuries.
- Cover to prevent loss of body heat.
- Make sure victim's clothes are loose. Loosen or cut if necessary.
- Do not give fluids unless victim is fully conscious and medical care will be delayed a long time.

  Note: Fluids may cause vomiting.

Objective 12

How to treat choking

Note: A person who is choking may have either a complete or a partial airway obstruction. A person with a complete air obstruction cannot speak, breathe, or cough and needs immediate help! With a partial obstruction, the person may be able to cough up whatever is causing the obstruction such as a piece of food. If they cannot clear the obstruction with coughing, they too will need emergency help.

a. Ask the victim, "Are you choking?"

   Note: The universal sign for choking is when the victim grabs his/her throat.

b. If the victim cannot speak, stand directly behind him/her so you can begin to administer abdominal thrusts using the Heimlich maneuver.

c. Wrap your arms around the victim's waist, and place your finger on their belly button.

d. Make a fist of the other hand, and put the thumb side of the fist just above your finger on the belly button (and below the ribs).

e. Take your finger off their belly button, and place this hand over your fist.

f. Give quick, upward thrusts into the abdomen. This forces air trapped in the lungs to push the object out of the airway.

g. Repeat the thrusts until they work or until trained help comes.

Objective 13

Guidelines for giving mouth-to-mouth breathing (artificial respiration)

Note: A person may stop breathing because of drowning, poisoning, heart attack, choking, or electric shock.

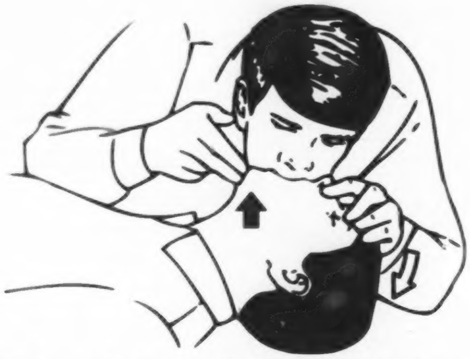
a. Check to see if victim is conscious or unconscious. Tap on his/her shoulder and shout out loud, "Are you OK?"

   - If the person responds (conscious), begin a secondary survey.
   - If the person does not respond (unconscious), call for emergency help (or send someone else to call), and go to next step.

b. Roll the victim so he/she is lying on their back. Try to roll him/her over all at once. Keep the neck and back straight.

c. Tilt the victim's head back and lift his/her chin so it is pointing straight up in order to make the airway straighter and more open.

Figure 1



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d. Check victim's breathing for five seconds to see if he/she is breathing. Watch the victim's chest to see if it moves up and down, and listen with your ear near the victim's mouth. You should feel their breath on your cheek.

- If the person is breathing, they do not need mouth-to-mouth breathing. Watch them and wait for help.
- If the person is not breathing, go to next step.

e. Pinch the victim's nose shut, put your mouth tightly over the victim's mouth, and gently give two breaths into the victim's mouth, each lasting about 1 1/2 seconds.

f. Check the victim's chest to make sure it rises and falls with each breath. If it does not rise and fall, then the air is not getting in. Check the airway for obstructions and give abdominal thrusts (Heimlich) to force out the obstruction.

g. Check the victim's pulse by placing your fingers flat against the side of the neck (in the crease of the neck).

- If the person has a pulse but is not breathing, continue the mouth-to-mouth breathing.
- If the person has no pulse and is not breathing, perform CPR if trained.

h. Continue to give breaths with four-second waits between breaths until the victim starts to breathe or until trained help comes.

Note: If the victim is a child, you will need to seal off both the child's mouth and nose. Also use less force on the breaths you give.

Objective 14

Basic steps for performing cardiopulmonary resuscitation (CPR)

Note: This written material alone will not give you enough information or experience to perform CPR, but you will have a basic understanding of how it is done. To gain the skills of CPR, it is necessary to practice on manikins, with certified instructors as guides. Contact your local hospital or American Red Cross for more information about classes.

a. Check victim's pulse and breathing, and call for emergency help.

Note: Information on how to do this was given with the guidelines for mouth-to-mouth breathing, Objective 13.

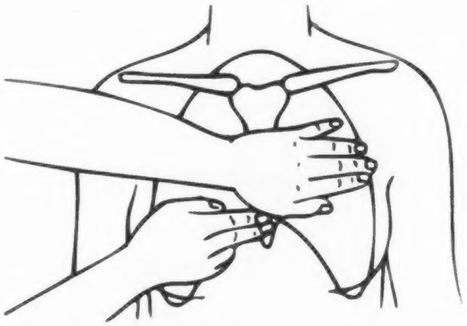
- If victim has a pulse but is not breathing, give mouth-to-mouth breathing. No CPR is needed.
- If the person has no pulse and is not breathing, go to the next step to begin CPR.

Note: CPR consists of cycles of chest compressions and mouth-to-mouth breathing.

b. Position hand correctly on the victim's chest.

- Find the notch where the lower ribs meet the breastbone.
- Place the heel of your hand on the breastbone, next to this notch area.
- Place your other hand on top of the first.

Figure 2



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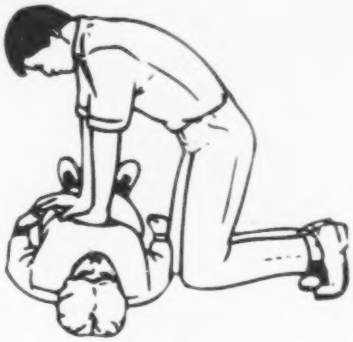
c. Position yourself kneeling next to the victim with your shoulders directly over your hands, with your elbows locked.

Figure 3



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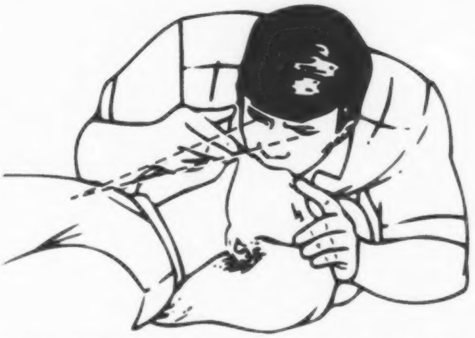
d. Compress the chest by pressing down 1 1/2–2". Then release. Push with the weight of your upper body.

e. Keep a steady down-and-up rhythm, and don't pause between compressions. Count "one and two and three and four and five and six and..." to establish a smooth, steady rhythm.

f. Give 15 compressions, then give 2 slow breaths. This cycle of 15 compressions and 2 breaths takes about 15 seconds total.

Figure 4



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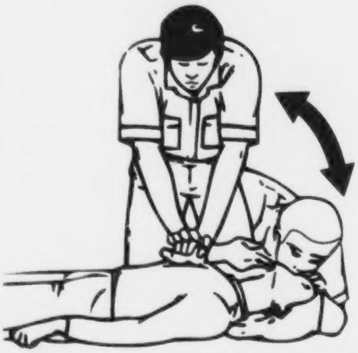
g. Give 4 continuous cycles of CPR, and then check pulse.

Figure 5



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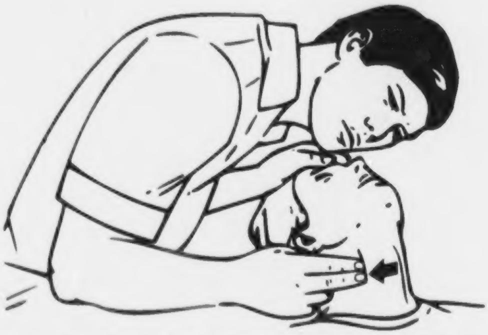
- If there is a pulse, check victim's breathing. If he/she is still not breathing, continue mouth-to-mouth breathing but discontinue chest compressions.

Figure 6



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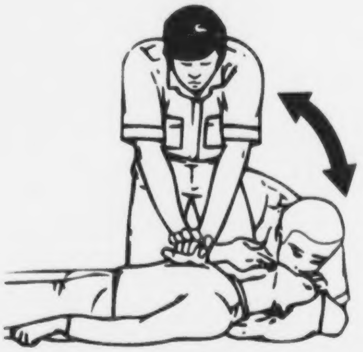
- If there is still no pulse, continue giving CPR in cycles of 15 compressions and 2 breaths with pulse checks every 4 cycles.

Figure 7



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Note: Do not stop CPR unless another trained person or emergency personnel can take over or the victim's pulse and breathing return. Most victim's hearts will not start without electrical stimulation which can only be administered by medical personnel. However, your efforts are critical for keeping oxygen circulating to their brain until medical help arrives.

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Objective 15

Assignment Sheet 1—Determine Basic First Aid Measures for Given Emergency Situations

Name ______________________ Overall Rating __________

Date ______________________

Evaluation Criteria	**Rating**
• Directions are followed	_____
• Discussions reflect good knowledge of basic first aid measures	_____

Basic Skills

Reading

Writing

Critical Thinking

Employability

Directions

Read the accident scenarios below and write the emergency and first aid actions you would take.

1. One hot day while working in a tightly closed shop, co-worker Jane tells you that she feels dizzy and has a headache. She suddenly faints. Her skin is red, very hot, and dry. What emergency and first aid measures should you take?

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2. Co-worker Gary has been splattered with gasoline, and he was burned when the gasoline caught fire. The resulting burn is deep with a lot of tissue damage. Gary does not feel much pain. What emergency and first aid measures should you take?

3. A customer was walking by some parts being uncrated when she stepped on a nail. The nail penetrated her shoe and entered her foot. There is minimal bleeding. However, she begins to complain of feeling queasy. You notice that her face is pale and her skin feels cool and clammy. Her breathing is rapid, shallow, and irregular. After a moment, she says she feels weak and wants to rest. What emergency and first aid measures should you take?

4. Co-worker Robert was plugging a battery charger into an extension cord in the wash bay area of the shop. There was a popping sound and a puff of smoke. He screamed, fell over, and lay motionless on the floor. What emergency and first aid measures should you take?

5. Supervisor Susan is carrying a battery when she slips and falls. She hits the workbench with her head as she falls. Her head is cut and bleeding heavily. What emergency and first aid measures should you take?

6. During lunch, co-worker Ted begins to cough and then to choke. When you see him, he's not coughing anymore and he can't talk or breathe. What emergency and first aid measures should you take?

7. Co-worker Lisa cuts her hand on a piece of glass. She says, "It's nothing. Don't worry about me." What emergency and first aid measures should you take?

8. Co-worker Todd got dirt and other debris in his eye when he was removing a part from a truck he was working on. He's rubbing his eye, but this seems to be making it worse. What emergency and first aid measures should you take?

9. Co-worker Angela slipped and fell from a ladder. She landed on her left arm. She says that arm really hurts and she's afraid to move it. There is no break in the skin, but the arm looks funny. What emergency and first aid measures should you take?

10. Supervisor Steve is complaining of chest pain and indigestion. He says, "It must be something I ate." His breathing is difficult, and he looks pale and worried. What emergency and first aid measures should you take?

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